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Air Carrier Airports Final Report

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AIR CARRIER AIRPORTS

Final Report


Prepared for the Regional Airport Planning Committee

April, 1980

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Regional Airport Planning Committee

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**Consultants Assisting in the
Regional Airport Plan Update Program**

<u>Consultant</u>	<u>Tasks</u>
Association of Bay Area Governments	<ul style="list-style-type: none">● Airport Employment Projections and Impacts● Air Quality Analysis● Airport Noise Impact Assessment● Environmental Impact Report
California Department of Transportation	<ul style="list-style-type: none">● Airport Employee Survey● Inventory of Ground Access Facilities and Services● Analysis of Ground Access Capacity● Analysis of Highway Congestion● Truck Traffic Forecasts● Airport Parking Requirements
Hodges and Shutt/Aviation Planning Services	<ul style="list-style-type: none">● Air Cargo Forecasts● Aircraft Operations Forecasts● Aircraft Operations Input to Noise Model● Airport Capacity Analysis
Peat, Marwick, Mitchell & Company	<ul style="list-style-type: none">● Airspace Capacity Analysis
The Parry Company	<ul style="list-style-type: none">● Noise Model Calibration● Noise Model Projections
The Transpo Group	<ul style="list-style-type: none">● Potential Diversion of Passengers to Future Rail Modes● Air Passenger Mode Split Model

Chris Brittle, Project Manager

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ADDENDUM

On October 22, 1980 the Metropolitan Transportation Commission (Commission) adopted the airport revisions to the Regional Transportation Plan and certified the EIR for the Regional Airport Plan. As a result of this action, the following have been incorporated in the Regional Airport Plan:

1. The recommendations from the North Bay Aviation Study--adopted by the Regional Airport Planning Committee on July 30, 1980--relating to the North Bay Airports are incorporated in the Regional Airport Plan.

Short Range Need

- o The North Bay should play a larger role in relieving general aviation traffic around the region's commercial airports in conjunction with capacity limitations where required.
- o The primary reliever general aviation airport role should be shared by Hamilton AFB, Napa County, Sonoma County and Nut Tree airports, with local government permitting only compatible land use around these airports.
- o Hamilton AFB and Napa County Airport have the greatest potential to relieve general aviation congestion around San Francisco and Oakland airports; Sonoma County and Nut Tree airports (Travis AFB is not available for reliever use) will provide relief by serving local training demand; and these four airports should permanently be limited to general aviation.
- o Funding priority in the North Bay shall be given to general aviation airports and their related access facilities serving a reliever role and having a full Instrument Landing System (ILS) that is compatible with at least 50% of the normal air traffic pattern.
- o Responsible agencies look into management techniques at existing airports to control noise and improve capacity. An off-airport terminal in the North Bay could improve transit use to existing airports.

Long Range Need

- o Review need for California Corridor service and/or regional airport (international and interstate airline service) at Travis AFB or a new airport in ten years, and encourage local government to permit only compatible land uses around Travis AFB.

2. Objective 1.9 on page 26 is amended to read

RAPC shall comment on any airport's expansion in that airport's permit process, especially as to the desirability of the project in relationship to regional airport needs and to the suitability of the site of the expansion as compared to alternatives.

3. Plan Implementation Policy 1.1 on page 26 is amended to read.

The Regional Airport Plan (RAP) shall guide the Commission in its review of airport plans and development proposals.

4. Plan Implementation Policy 1.5 on page 27 is deleted.

5. Airport Noise Policy 1.5 on page 27 is amended to read

Airport noise abatement plans shall specifically consider the need to mitigate loud single events, particularly those occurring in the late evening.

6. Airport Noise Policy 1.8 on page 27 is amended to read

Noise insulation and noise easements shall not be used as a means to achieve compliance with the State's noise standards for large new developments in proximity to existing or proposed airports.

7. Airport Noise Policy 1.9 on page 27 is amended to read

Legislation that would substantially delay the Federal compliance schedule for retirement of aircraft that do not meet FAR Part 36 noise certification standards shall be opposed.

8. Airport Noise Policy 2.0 on page 28 is amended to read

Air traffic routings and procedures shall place a high priority on reducing aircraft noise including "overflight" noise at higher altitudes. Changes in flight procedures that result in a shift in noise levels from one part of the Bay Area to another shall be coordinated with regional agencies and local jurisdictions.

9. Airport Noise Policy 2.1 on page 28 is deleted and Policy 2.2 becomes 2.1.

10. Further, the Commission made the following edits to the North Bay Aviation Study Final Report (July, 1980): Page IV-51 is corrected to read

Such federal concerns are just now being understood via experience learned at other airports...

11. Page IV-61, paragraph 2, is amended to read

There have been recent changes to local land use policies for Hamilton AFB resulting in incompatible residential development being located within noise impact boundaries and which provide for industrial/commercial development that is potentially incompatible from a safety standpoint.

I. INTRODUCTION

Background

Air transportation provides a vital link between the San Francisco Bay Area and other parts of the country. Despite cyclical fluctuations, passenger and cargo traffic continues to increase. Additional demands on the regional airport system will present major challenges: the need to develop and finance new airport facilities, the need to minimize airport noise and air pollution, and the need to conserve energy. These challenges will require new ways to expand and operate airports and to manage the development of airline service.

Because many issues concerning airport expansion are regional in nature, the Association of Bay Area Governments (ABAG) and the Metropolitan Transportation Commission (MTC) have prepared a plan to guide future aviation growth in the nine-county San Francisco Bay Area.

Preparation of a regional airport plan began in the late 1960's. The original Regional Airport System Study (RASS) was adopted in 1972 after extensive public hearings. Revisions were later made to the plan, particularly in the area of the demand forecasts. These revisions are currently incorporated in the Airport Element of MTC's Regional Transportation Plan and ABAG's Regional Plan.

After several years, it became evident that the original plan needed to be updated. The Regional Airport Plan Update Program (RAPUP), conducted under the auspices of the ABAG/MTC Regional Airport Planning Committee (RAPC), was funded by the Federal Aviation Administration for this purpose. Included in the current planning program is a revised Environmental Impact Report for the recommended plan.

Reasons for Revising the Plan

The airport system plan needs to be revised to provide a more useful and effective policy tool for ABAG and MTC in making decisions concerning airport and airline service development. It needed to:

- reflect current information regarding aviation growth
- clarify and emphasize various environmental issues, such as noise, air quality, and energy conservation
- reflect the results of recent airport planning studies including the Oakland Airport Master Plan, the San Francisco/San Mateo Joint Land Use Study, and the San Jose Airport Master Plan and Vicinity Area Plan.

The update study, therefore, focuses on these matters, giving particular attention to the development of policies that correctly reflect the regional agencies' role in airport planning.

Effectiveness of Past Plans

Despite the laudable goals in the regional plan, implementation of the policies and recommendations has proved difficult because it relies almost solely on the persuasive powers of the regional agencies to get airlines, airports, and Federal, State and local government to agree to the recommendations. The greatest drawback of past plans is that the policies have required compromises that are greater than any of the participants are willing to make.

One of the major lessons to be learned from past experience is that a clear strategy is needed for relating policies with their method of implementation. Those policies that are readily agreeable to all agencies involved in airport planning can be implemented through cooperative methods. On the other hand, controversial policies that are not expected to gain cooperative support should have a clear statement as to how they could be carried out.

What Will the Plan be Used For?

The plan provides the policy by which ABAG and MTC make decisions in the following areas:

1. Conformance of Local Plans and Projects with the Regional Airport Plan
 - Airport Master Plans
 - Airport Land Use Commission Plans
 - Local Government General Plans
 - Airport Development Projects
 - Environmental Impact Reports
 - Ground Transportation Facilities and Services
 - Housing and Land Use Projects
2. State and Federal Actions Affecting Airport Development
 - Allocation of Funds to Airports
 - Airline Routes/Adequacy of Service
 - Disposal of Military Airports
 - Variances from the State Airport Noise Standards

3. State and Federal Legislation Affecting Airport Planning

- Airport and Airways Development Act (Funding)
- Federal Aviation Act (Deregulation)
- Airport Land Use Commission Reform
- California Transportation Plan Policies
- Federal Aviation Noise Policy
- Federal Energy Policy

II. SUMMARY

In the late 1960's the Association of Bay Area Governments (ABAG) and the three regional airports began studying the need for future aviation facilities in the San Francisco Bay Area. The Regional Airport System Study (RASS) Committee was subsequently formed, consisting of an elected official from each of the nine Bay Area counties and representatives from the three airports. The purpose of the Committee was to develop policy and make final recommendations. Their work culminated in 1972 in an adopted plan. Additional work has taken place since that time to keep the plan current and to implement its recommendations. The inclusion of an aviation element in the Metropolitan Transportation Commission's (MTC) Regional Transportation Plan is now mandated by State law.

The need for a regional overview of airport planning has long been apparent. The use of Bay Area airspace is already "managed" by a quasi-regional agency, in this case the Federal Aviation Administration's Terminal Radar Approach Control Facility, since aircraft operations at one airport interact with operations at other Bay Area airports. Several other factors are also relevant:

- Airports in the Bay Area serve a broad regional demand for passenger and cargo service extending well beyond the immediate jurisdiction of the airport operators.
- Noise from aircraft landings and takeoffs and from aircraft "overflights" affects a large number of Bay Area communities. Certain communities have borne the major effects of the growing regional demand for air transportation simply because they are located near the airports.
- Emissions from aircraft and automobiles affect regional as well as local air quality.
- Ground transportation improvements often involve coordination among more than one political jurisdiction. The programming of funds for highway and transit improvements takes place at the regional level.
- Conservation of energy has emerged as a major goal in transportation planning. How new airline service is developed in the region will have a significant impact on the consumption of transportation energy both on the ground and in the air.
- Airport expansion has historically resulted in some filling of the Bay. Protection and enhancement of the Bay as one of the region's most significant environmental resources is an important concern.

The purpose of the current Regional Airport Plan Update Program (RAPUP) is to review each of the criteria used in developing the recommended airport system plan, to make the plan more explicit with respect to mitigating adverse environmental impacts, and to make the plan more useful for implementing regional policy. The policies and recommendations will be used to revise the Airport Element of the Metropolitan Transportation Commission's Regional Transportation Plan and the Association of Bay Area Government's Regional Plan. The Joint ABAG/MTC Regional Airport Planning Committee (RAPC), an advisory committee to ABAG and MTC, is responsible for guiding the study and formulating the final recommendations.

The Regional Airport System

Regional aviation demand is served by San Francisco, Oakland, and San Jose Airports. (See Figure II-1)

CURRENT AIRPORT ACTIVITY LEVELS

<u>Airport</u>	<u>1979 Passengers*</u>	<u>1979 Cargo** (Thousands of Tons)</u>
San Francisco International	22,600,000	485,000
Oakland International	2,700,000	12,100
San Jose Municipal	<u>3,600,000</u>	<u>10,900</u>
Regional Total	28,900,000	508,000

*Excludes estimated "through" passengers

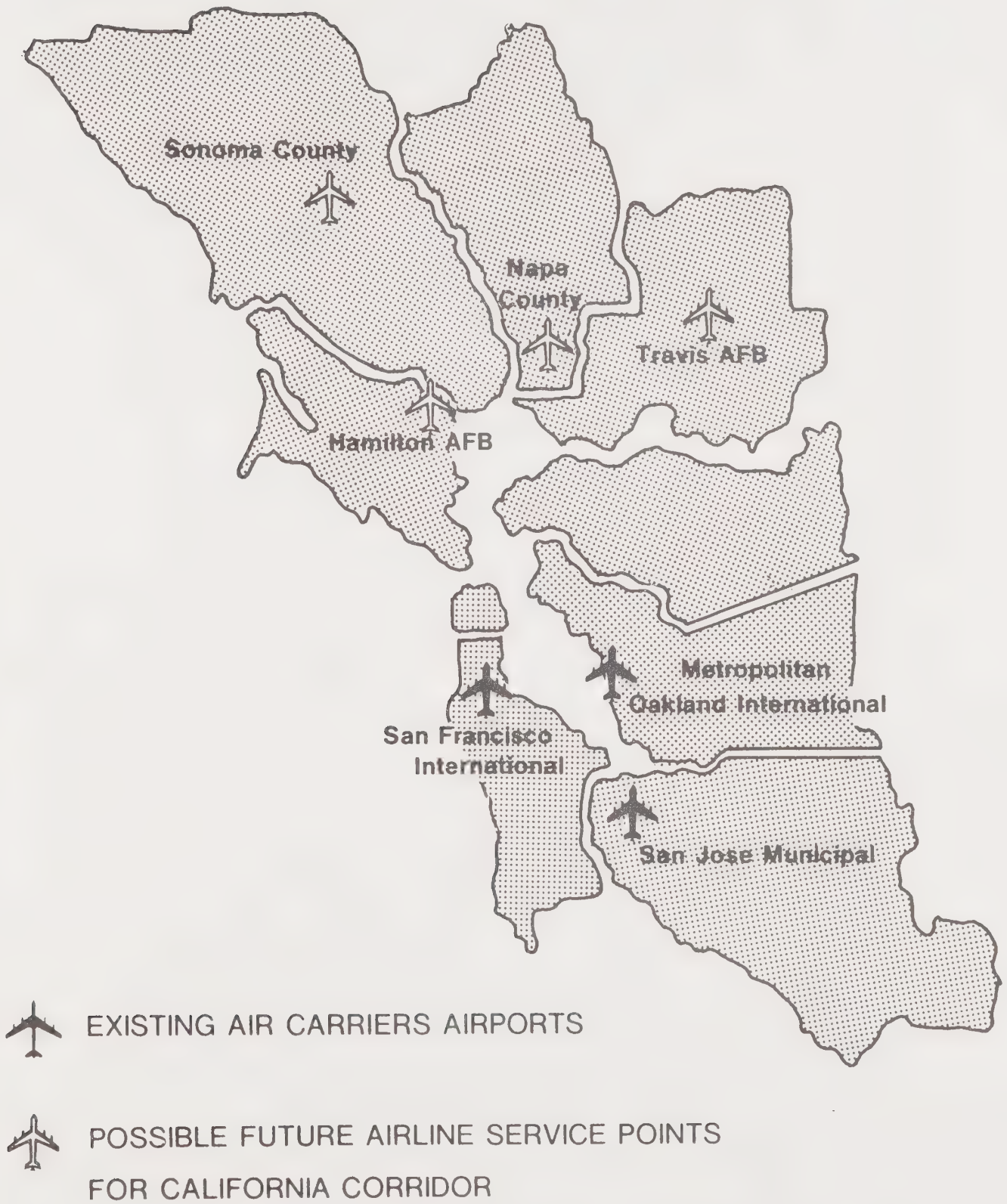
**Includes air freight and air mail

The San Francisco Bay Area is the fifth most active airport "hub" in the United States behind Chicago, New York, Atlanta, and Los Angeles. San Francisco Airport, the region's major airport, handles 78% of the passenger traffic and almost all of the air cargo. International service as well as a significant portion of domestic service is located at San Francisco Airport. Private investment in passenger service facilities, aircraft service facilities and air cargo facilities is substantial.

Oakland Airport's share of Bay Area passenger traffic averages between 9% and 10%. Oakland's activity rose sharply in the late 1960's when intrastate carriers inaugurated new service in California markets. Between 1965 and 1969 there was also rapid growth in service to Europe and Hawaii by supplemental air carriers headquartered at Oakland. This service subsequently declined in the early 1970's as scheduled carriers introduced competing low group fares. Development of new interstate service has fluctuated with the economy and airline profitability.

Figure II-1

BAY AREA AIRPORTS



San Jose Airport's share of Bay Area passenger traffic is about 12% and has been gradually increasing on the strength of economic and population growth in the South Bay and new airline service. Like Oakland, San Jose's development received a major impetus in the late 1960's with the inauguration of new intrastate service. The airport has been somewhat more successful than Oakland Airport in attracting and retaining new interstate service.

Overview

The regional airport plan must meet a broad range of objectives. These include providing a convenient and safe air transportation system to serve future demand as well as minimizing adverse effects of aviation growth such as increased aircraft noise and air pollution. While the concept of a regionally planned air transportation system is attractive, the historic objective of dispersing airline service among the Bay Area airports has not been achieved, largely for economic reasons. Thus the environmental benefits of the regional plan, particularly with respect to noise reduction, have been indefinitely postponed.

Other multiple-airport hubs across the country have experienced similar difficulties in fostering traffic development at underutilized airports. The reasons for this are discussed below.

- **Magnitude of Private Investment** - Existing and future financial commitments by the airlines at San Francisco Airport are substantial. Duplication of services and facilities at other airports increases airline costs. Airline policy, in general, is to develop new facilities when existing facilities become saturated. Thus, the major expansion and modernization program under way at San Francisco will have a continuing impact on development at other Bay Area airports for a number of years.
- **Economics and Fuel** - During periods of moderate economic growth and healthy airline profits, service has increased at Oakland and San Jose. During periods when fuel is scarce and the economic outlook worsens, marginal flights are cancelled in favor of concentration of service at larger airports. Continuing airline investment in bigger aircraft will also tend to concentrate service at the major hub airports where higher passenger loads can be obtained.
- **Regulation** - The regulatory framework has not worked in favor of the regional plan. Extensive "co-terminal" and "hyphenated" authority existed for a number of years prior to the passage of the Airline Deregulation Act in 1978. Under this type of authority Oakland and San Jose were often listed on the same route certificate as San Francisco, and service to San Francisco fulfilled an airline's obligation to serve the other Bay Area airports.

- **Regional Powers** - Regional authority over the development of the airport system is restricted to the review of projects for consistency with the regional airport plan. MTC statutes require a finding of consistency for a project to be approved. However, a fundamental problem is that regional actions influence facilities but not service. While building airport facilities can provide the potential for increased service, the construction of a new terminal at Oakland, for instance, will not itself produce any more service.

Conversely, a restraint on development at San Francisco will not necessarily encourage passengers or airlines to use other airports; rather this condition may merely increase congestion and inconvenience to an intolerable level. Thus the use of facilities to manage growth is an imprecise method at best. (The statutory powers of the MTC have, however, been used to condition approval of airport funding applications when mitigation measures for noise, air quality, or surface traffic were clearly lacking or inadequate.)

In an attempt to develop better airline service at Oakland, the ABAG/MTC Regional Airport Planning Committee became a party to the Oakland Service Case. Initiated in April, 1977, by the Port of Oakland, the service case requested the Civil Aeronautics Board (CAB) to grant new or improved service to Oakland in 22 specific markets and to suspend the "dormant" or unused authority of those carriers who were certificated to serve the Oakland markets but had not chosen to do so. The CAB responded by making the Oakland case a test case for a major change in regulatory policy called multiple permissive authority. Rather than selecting carriers for specific routes, all carriers who met the "fitness" criteria were presumed capable of service and were granted authority.

While the major thrust of the Oakland case was to develop new authority specifically to Oakland, the subsequent passage of the Airline Deregulation Act of 1978 led to a broad reshuffling of corporate strategies and airline routes. This Act essentially eliminated many of the incentives for new carriers to "Fly Oakland," although it did contain a policy calling for development of satellite airports.

- **New Ideas** - Under the sunset provisions of the Airline Deregulation Act, the CAB will gradually go out of business, first abandoning its authority over routes (in 1981) and then over fares (in 1982). This Act offers little opportunity to work through a regulatory framework to achieve regional objectives.

Instead, other more contemporary strategies must be studied and tried. In its discussions with RAPC and the Bay Area airports, the CAB has supported the use of economic incentives to obtain overall regional goals. For instance, airport fees could be set high at one airport and lower at another airport to promote the use of the underutilized airport. This approach would require the renegotiation of existing airport/airline agreements to permit higher fees and/or charges.

Another concept has to do with the "slotting" of traffic to one or more airports. Airline "slot" committees exist at certain congested airports in the country to allocate the use of airspace during critical hours of the day. This approach could be used on a regional scale to affect more efficient utilization of airport and airspace capacity and to reduce regional airport noise exposure. The method used to allocate airport slots would be critical since both the CAB and the Federal Aviation Administration (FAA) have expressed concerns over systems that are discriminatory or anti-competitive or that place an undue burden on interstate commerce.

One of the major issues that needs to be addressed is the institutional framework for implementing any of the strategies discussed above. In particular, actions by individual airport operators acting collectively for the benefit of the whole (read Bay Area) may be considered anti-competitive, while similar actions by an authority or district might be legally acceptable.

The Study Approach

The Committee's review of the regional airport plan focused on two principal areas of concern; the evaluation of future airport system alternatives, and the analysis of potential mitigation measures. An airport system alternative represents a specific distribution or "allocation" of passenger traffic among the Bay Area airports for future years. An alternative defines the type of service at each airport, the location of passengers that use the airport, the number of aircraft flights, and the amount of surface traffic. These factors in turn are used to calculate regional effects associated with airport system capacity, airport noise levels, air pollution, and energy consumption. Mitigation measures for airport noise, air quality, and energy consumption were combined with different airport system alternatives (which have their own inherent "system" mitigation capabilities) to determine the effectiveness of existing and proposed regional policies.

The formulation of airport alternatives for this study is the result of an evolutionary process that began in 1969 with the Regional Airport System Study (RASS).

Current demand projections and past policy decisions limit the scope of the airport system alternatives that were reviewed. Two major assumptions have been made with respect to the development of the regional airport alternatives:

- 1) Maximum use shall be made of existing airports in accommodating projected levels of demand.
- 2) Development of a new regional airport in the Bay Area is not feasible because of the magnitude of the costs and the difficult environmental issues that would have to be faced.

Several other developments have a bearing on the airport system alternatives. First, after several years of study, the City of San Jose dropped from further consideration the possibility of developing an entirely new airport to replace the existing air carrier facility. Second, MTC and Solano County completed a study to determine the feasibility of joint civilian-military use of Travis AFB. Third, Hamilton AFB was declared surplus by the federal government in 1976 and is being disposed of by the General Services Administration for possible aviation use.

Airport System Alternatives

The major airport system alternatives evaluated for this Study are described below and shown in Figures II-2 and II-3.

- Alternative 1 - Existing Airport Shares. This alternative assumes that the current share of regional demand served by each airport will not change substantially in the future.
- Alternative 2 - Airline Plan. This alternative assumes that traffic at San Francisco Airport would continue to grow until the Airport becomes saturated. The airlines would then start to develop Oakland Airport.
- Alternative 3a - Regional Airport Plan. Under this alternative Oakland and San Jose Airports would handle a significantly larger share of regional demand than at present.
- Alternative 3b - Regional Airport Plan with North Bay Airport. This alternative is similar to 3a except that either Hamilton AFB, Sonoma County Airport, Napa County Airport, or Travis AFB is used to provide service for 1 to 2 million annual air passengers in the North Bay. This is the demand generated in the "California Corridor" between San Francisco and San Diego which generates around 40% of the Bay Area air traffic.
- Alternative 4a - San Jose Constrained. This and subsequent alternatives measure the impact of limiting traffic at San Jose Airport to 5.3 and 8 million annual passengers in 1987 and 1997. These levels are the levels proposed in the Airport Master Plan. In Alternative 4a overflow from San Jose Airport is accommodated at San Francisco Airport.
- Alternative 4b - San Jose Constrained. This alternative assumes that overflow from San Jose Airport is accommodated at Oakland Airport.
- Alternative 4c - San Jose Constrained. This alternative assumes that regional demand is accommodated by expanding a North Bay Airport while constraining San Francisco and Oakland Airports to previously recognized policy limits.

Figure II-2

1987 AIR PASSENGER VOLUMES BY ALTERNATIVE
(MILLIONS OF ANNUAL PASSENGERS)

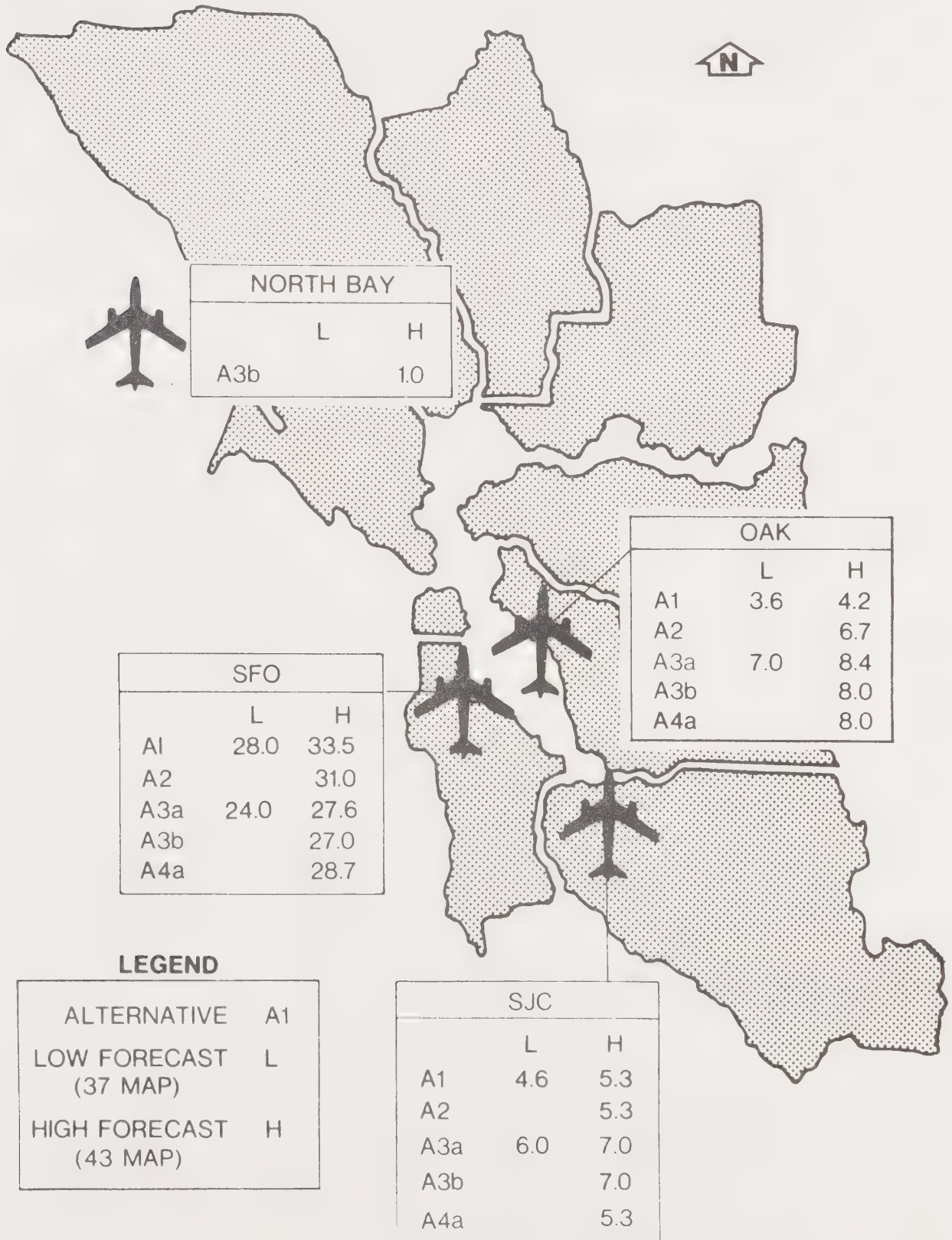
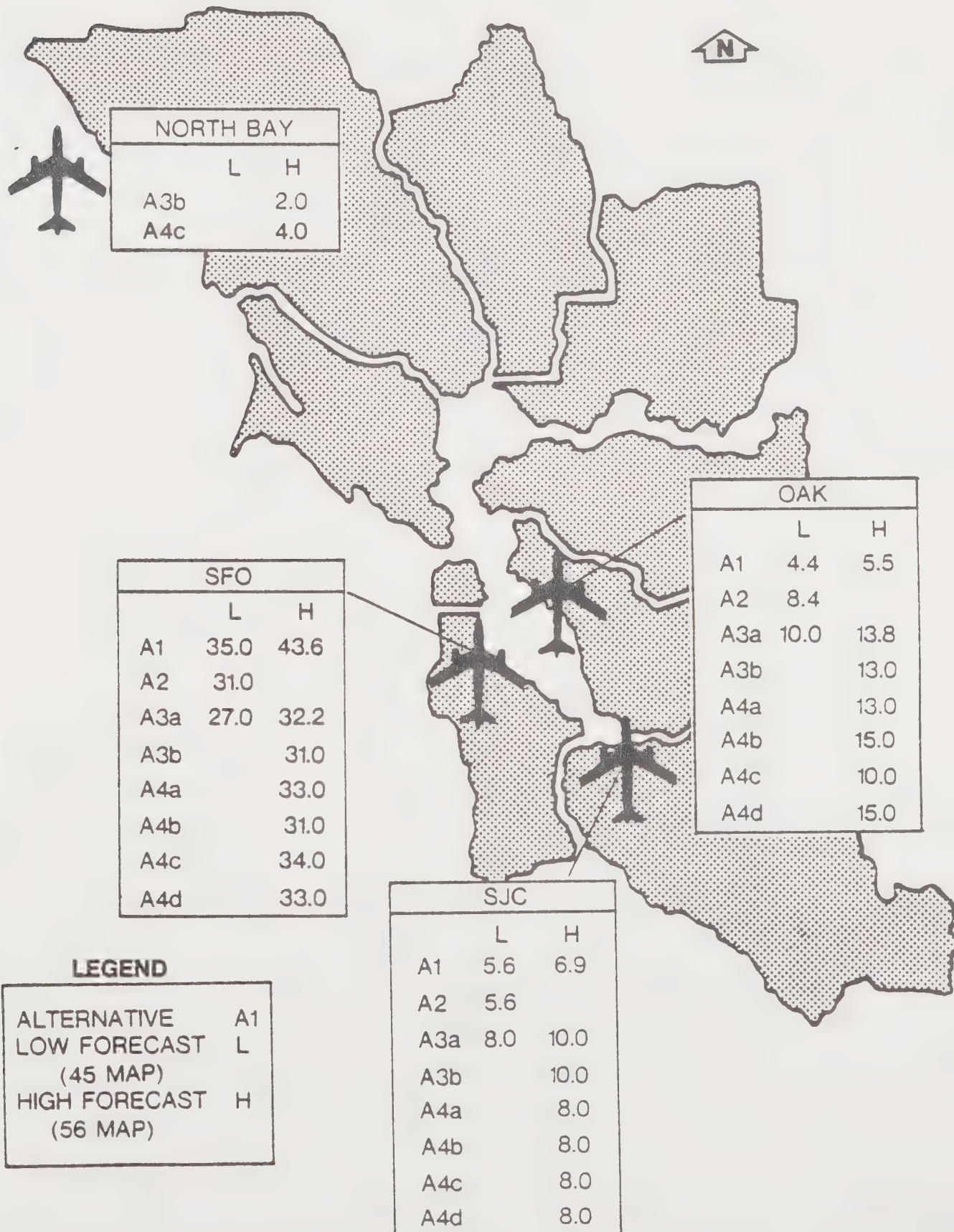


Figure II-3
1997 AIR PASSENGER VOLUMES BY ALTERNATIVE
 (MILLIONS OF ANNUAL PASSENGERS)



- Alternative 4d - San Jose Constrained. In this alternative San Jose is constrained to 8.0 million annual passengers and there is no North Bay Airport. Traffic allocations to San Francisco and Oakland Airports are increased to accommodate regional demand.

Aviation Forecasts

- Airline deregulation, the rising cost of fuel, and general economic conditions will all have an effect on future air travel demand. The result of these forces will be that the demand for air travel will continue to increase but at slower rates than in the past. The number of passengers using Bay Area airports is projected to increase from 29 million passengers in 1979 to 37-43 million passengers in 1987 and 45-56 million passengers in 1997.
- The gateway position of San Francisco Airport in relation to developing nations around the Pacific Ocean will continue to be a major factor influencing growth in air freight. Air freight tonnage handled through Bay Area airports is projected to increase at an average annual rate of 6-8% throughout the forecast period.
- The number of passengers carried per airline operation will also steadily increase as airlines continue to add larger aircraft to their fleets and retire smaller and older aircraft. These aircraft will be quieter and more fuel-efficient than their predecessors. The number of takeoffs and landings by major airlines will increase at a much slower rate than the growth in air passengers.
- The growth in operations by Third Level airlines could be dramatic. As airlines using larger aircraft pull out of smaller California cities, Third Level (also termed Commuter Airlines) will assume a larger role in "feeding" traffic into the major metropolitan area airports.

Airport and Airspace Capacity

- The capacity of the runways at each airport--considering both air carrier and general aviation activity--was calculated to be: San Francisco Airport - 400,000 annual operations, Oakland South Airport - 184,000 annual operations, San Jose Airport - 770,000 annual operations. Of this total capacity, the capacity available for air carrier use was estimated to be: San Francisco Airport - 330,000 annual operations, Oakland South Airport - 170,000 annual operations, and San Jose Airport - 100,000 annual operations.
- The total runway capacity available at the three Bay Area airports will be sufficient to handle projected 1997 demand; however, demand could exceed runway capacity at San Francisco Airport if traffic continues to be concentrated at this airport. Under these conditions delays at San Francisco for arriving and departing aircraft would be substantial.

- The capacity of the airspace was analyzed under several different conditions. A major constraint for the system occurs during the 8% of the year when the airports are operating under Instrument Flight Rules (IFR) weather--when the ceiling is below 1000 feet and visibility is below 3 miles. Under these conditions airspace capacity is reduced by half compared to normal visual flying conditions.
- The effective capacity of the Bay Area airspace is increased and delays are minimized if traffic could be redistributed among Bay Area airports as recommended in the regional plan. However, even under the regional plan (Alternative 3b), airspace capacity would not be sufficient to handle peak period demands estimated for IFR weather in 1997. Methods to resolve this problem include managing demand through peak period quotas or surcharges, shifting a portion of the traffic to a North Bay Airport, improving air traffic control equipment so more aircraft can be safely handled, or constructing new runways at existing airports.
- Delays could increase more rapidly than estimated in this study as a result of the significant growth in Third Level airline traffic--which involves the use of small aircraft and results in the need to increase separation between landing and departing aircraft.

Airport Ground Access Capacity

- Airport ground access problems at San Francisco Airport include congestion on Route 101 south of the airport and inadequate parking and circulation on the airport. Potential problems at Oakland Airport include congestion on Route 17 south of the airport and the ability of the local street system serving the airport to handle growth in airport and local area traffic. Major problems at San Jose Airport include the reliance of the airport on two congested freeways--Route 17 and Route 101--for airport access, the lack of adequate connections to these freeways, and the low level of transit use to the airport.
- A specific definition of future capacity problems on freeways serving the airports can be elusive because of the tendency for urban travelers to shift travel routes, trip times, or modes of transportation when congestion on their normal route becomes unacceptable. Generally speaking, regional transportation and land use studies show that traffic demand on all major freeways serving the Bay Area airports will grow; hence the potential for continuing and probably increasing congestion. This congestion will be mitigated to the extent that the increasing cost of gas results in less driving or a shift to various transit modes.
- San Francisco Airport is a major user of freeway capacity in the vicinity of the airport, hence regional plans to shift some traffic to other Bay Area airports will help alleviate congestion. Oakland Airport would not be a significant user of freeway capacity until

1997 and only if the activity levels contemplated in the regional plan were served. Surface traffic to San Jose Airport is distributed over a number of different freeway segments, thus the airport's impact on any one segment is minimized.

- Regional policies call for development of effective transit and ridesharing programs at each airport to reduce the impact of airport growth on local streets and highways and to reduce energy consumption and local air pollution. Currently 60% of the region's air passengers use a personal car to get to the airport, 29% use a taxi or rental car, and 15% use public or private transit. Of the airport employees, 75% use their personal car, 15% are involved in carpools or vanpools, and 8% use public transit.
- Analysis of the effect of increased transit use, ridesharing, and long term parking on airport traffic shows varying results at each airport. These differences have to do with the relative proportion of passenger, employee, and "other" traffic (air cargo, airport service and maintenance vehicles, etc.), the proportion of resident and visiting air passengers, and existing mode choice habits. In summary, it was found that the combined effect of the strategies mentioned above would be a 9-12% reduction in surface traffic compared to basecase conditions at San Francisco Airport, and a 21-25% reduction at Oakland and San Jose Airports.

Airport Noise Impacts

- Airport noise is unquestionably the single most important environmental issue that must be addressed when considering future expansion of airline service and airport facilities. Noise projections were made at each airport over a range of possible future activity levels. The major issues addressed in the regional study included the effect of a redistribution of traffic among Bay Area airports on total noise exposure in the region, the effect of regulatory initiatives and new technology aircraft on future noise levels, the effect of controls on noise in the late evening on airport noise, and the impact of limited SST operations on noise at San Francisco Airport.
- In California, noise is measured using the Community Noise Equivalent Level (CNEL) which weights daytime, evening, and late night aircraft operations to determine community response to noise. Airport noise is regulated by the State, and airport noise levels must not exceed 70 CNEL in residential neighborhoods by January 1, 1981 and 65 CNEL by January 1, 1986. Variances may be granted by the State, but are normally conditioned on the airport preparing an acceptable noise abatement program.
- Regional studies show a worsening noise trend, despite federal laws that will produce a quieter aircraft fleet in the future. Part of the projected increase in regional airport noise exposure is due to the increase in number of aircraft operations; part of the increase is also due to the development of new residences around Bay Area

airports, such as the Bay Farm Island development adjacent to Oakland Airport. Starting with an estimated 41,500 persons living in the 65 CNEL noise contour in 1976, this number could increase to anywhere from 46,000 - 61,000 persons in 1987. Since total compliance with the State's noise standards would be extremely difficult, if not impossible, regional goals for noise abatement must be structured accordingly.

- Under the regional plan (Alternative 3b), Bay Area noise exposure would be minimized due to the shift of a major portion of traffic to Oakland Airport, with its overwater approaches and departures, and a shift of a small portion of traffic to a North Bay airport. Noise exposure at San Francisco Airport would be significantly reduced over present levels while noise exposure at Oakland and San Jose Airports would be increased.
- Federal regulations will require most aircraft that do not meet federal aircraft noise certification requirements to be retired from the airline fleet by 1985. These regulations will provide major noise relief for Bay Area communities compared to the noise environment without the Federal action.
- Controls on late night operations--in the form of limits on numbers of operations or limits on individual aircraft noise levels--could be used to significantly reduce community noise levels. Implementation of such controls would require careful consideration of the economic impacts of reduced late night operations, particularly for air cargo carriers, and the effect on interstate commerce.

Aviation Impacts on Air Quality

- Under the Federal Clean Air Act of 1970 and the Clean Air Act Amendments of 1977, each state is required to prepare detailed implementation plans demonstrating how the ambient air quality standards are to be met. Many California regions, including the Bay Area, have exceeded some or all the air quality standards, thus emphasizing the need for an implementation plan. The Air Quality Section of the 1979 Bay Area Environmental Plan describes the Bay Area's implementation plan. The regional air quality analysis focused on three issues, the impact of aviation growth on regional oxidant problems, the impact of aviation growth on local air quality, and the effectiveness of selected mitigation measures on minimizing potential adverse air quality impacts.
- Aviation contributions to regional oxidant problems (i.e., aircraft and auto emissions of hydrocarbons and nitrogen oxides) would not be significant even under worst case conditions--no further improvement in aircraft engine emissions or in airport transit use and ridesharing. It was further determined that there were no significant air quality differences at the regional level among the airport system alternatives. When various aircraft emission controls were tested along with increased airport transit

ridership, the beneficial effects in minimizing airport-related emissions were found to be significant.

- Local air quality analyses focused on potential exceedances of the 1-hour and 8-hour carbon monoxide (CO) standards at the terminals and at various "receptor" sites located off the airport. For the 1-hour CO standard, only one site was found to exceed air quality standards, and that site was located at the south end of the main runway at San Jose Airport. Under the 8-hour CO standard, and assuming worst case meteorological conditions, more numerous exceedances were calculated, including the San Jose Airport Terminal, the area at the end of the runway, and several off-airport receptor sites at San Francisco Airport. Air quality problems at San Francisco Airport would be eliminated if the regional airport traffic distribution is assumed (Alternative 3b) or if mitigation is used in the form of reduced aircraft engine emissions, increased transit and ride-sharing, etc.

Energy Use

- The objective of the energy study was to assess the energy requirements of each airport system alternative with respect to three principal sources: 1) the energy used by airlines in providing service between the Bay Area and other major domestic and international air travel destinations, 2) the energy used in delays to aircraft landing and departing Bay Area airports, and 3) the energy used in ground transportation to the Bay Area airports.
- Fuel used by the airlines to provide service between the Bay Area and other air travel destinations constitutes approximately 98% of the energy use associated with each airport system alternative. Because the regional plan would result in a greater number of airline operations compared to the existing system which concentrates service at San Francisco Airport, energy consumption would be increased. This increase is partially offset by reduced ground travel distances and reduced aircraft delays. On balance the energy use associated with the regional plan was estimated to be about 5% greater compared to a continuation of the existing airport traffic shares.

Airport Facilities and Development Costs

- Each Bay Area airport is in a different stage of development. In 1968 San Francisco Airport began a major expansion and modernization program that will be completed in the mid-1980's. The cost of this program is approximately \$403 million in 1978 dollars. Inflation and delays, however, have continued to push costs upward. The remaining work involving reconstruction of passenger boarding areas, development of new federal inspection facilities, remodeling of existing terminals, and other miscellaneous construction items is currently estimated to cost between \$206 and \$255 million (1980 dollars).

- Oakland Airport completed a Master Plan in 1977 that outlined plans for enabling the airport to accommodate 6 million annual passengers. The terminal would need to be expanded and additional auto parking provided. The first phase of the airport improvement program, involving construction of a second level over the existing Finger Building, has been started. The cost of airport improvements recommended in the Master Plan totals \$45 million in 1977 dollars.
- San Jose Airport completed its Master Plan in 1980. The major features of the plan include expansion of the terminal in a linear fashion, extension of both main runways for noise abatement and for increased operational flexibility, major improvements to the airport ground access/egress system, and expansion of cargo handling facilities. The total cost of the capital improvement program required to accommodate projected 1997 demand (about 8 million annual passengers) was estimated to be \$104 million in 1979 dollars, excluding improvements to the general aviation facilities.

Airport Employment Projections and Impacts

- Airport employment projections were used to a) assess future airport access and parking requirements, b) assess the demand for off-airport land necessary to accommodate new hotels and freight handling businesses desiring proximity to airports, and c) understand the impact of airports on the Bay Area economy.
- Approximately 96% of all airline employees are located at San Francisco Airport and this airport will continue to dominate the airline employment picture in the Bay Area. While not approaching the same levels as San Francisco Airport, airport employment will grow more rapidly at Oakland and San Jose Airports as new airlines begin to serve these airports.
- The number of employees required to manage and operate Bay Area airports will grow slowly, particularly at San Francisco Airport where major economies of scale can be realized.
- Employment in the air freight sector could increase sharply and is expected to continue to be concentrated around San Francisco Airport. Growth in hotel employment around airports will not be as large as in the past due to increased competition from downtown areas.
- Finally, no clear relationship could be identified between growth in airport employment and growth in various categories of business that have traditionally indicated a desire to be in close proximity to airports.

Tabular Comparison of Airport System Alternatives

The following table provides a summary of the quantitative data used to compare the various airport system alternatives.

Table II-1

1987 SUMMARY COMPARISON OF AIRPORT SYSTEM ALTERNATIVES

YEAR	FORE-CAST RANGE	ALT.	DESCRIPTION	AIRPORT ALLOCATIONS (M.A.P.)	ANNUAL AIRCRAFT OPERATIONS	ANNUAL AIR CARRIER DELAY	AIRPORT GROUND ACCESS			AIR QUALITY EMISSIONS				
							AVE. DIST.	PASS. VMT	EMP. VMT	AIRCRAFT	AUTO	TOTAL	% REGION	
NOTES			-1-			-2-	-3-	-4-	-5-	-6-	-7-		-8-	
1987	LOW	1	Existing Airport Shares	SFO	28.8	405,570	10,500	21.9	643	285	13.2	7.3	20.5	1.3
			Passenger distribution	OAK	3.6									
			among airports same as	SJC	4.6									
			base year. Service con-	TOT	37.0									
			centrated at SFO											
	3a	Regional Airport Plan	SFO	24.0	423,340	7,020	18.6	562	301	13.9	6.6	20.5	1.3	
		OAK & SJC serve much	OAK	7.0										
		larger share of local	SJC	6.0										
		passengers	TOT	37.0										
	HIGH	1	Existing Airport Shares	SFO	33.5	460,610	18,920	21.9	748	307	15.1	8.7	23.8	1.6
			Passenger distribution	OAK	4.2									
			among airports same as	SJC	5.3									
			base year. Service con-	TOT	43.0									
			centrated at SFO											
		2	Airline Plan - Airlines	SFO	31.0	467,300	13,440	20.2	703	302	15.3	8.3	23.6	1.5
			emphasize new service at	OAK	6.7									
			OAK as SFO approaches	SJC	5.3									
			31 MAP policy limit	TOT	43.0									
3a		Regional Airport Plan	SFO	27.6	482,830	10,400	18.5	650	301	15.6	8.0	23.6	1.5	
		OAK & SJC serve much	OAK	8.4										
		larger share of local	SJC	7.0										
		passengers	TOT	43.0										
3b	Regional Airport Plan/	SFO	27.0	484,630	9,700	17.6	620	298	15.6	7.7	23.3	1.5		
	North Bay - Same as 3a	OAK	8.0											
	except limited intra-	SJC	7.0											
	state service added in	NB	1.0											
	North Bay	TOT	43.0											
4a	SJC Constrained -	SFO	28.7	465,860	11,650	17.9	630	300	15.5	7.7	23.2	1.5		
	Service at SJC con-	OAK	8.0											
	strained below local	SJC	5.3											
	demand levels for en-	NB	1.0											
	vironmental reasons,	TOT	43.0											
	but otherwise similar													
	to 3b													

Table II-1
1987 SUMMARY COMPARISON OF AIRPORT SYSTEM ALTERNATIVES (CONT.)

ALT.	ENERGY USE				NOISE			AIRPORT EMPLOYMENT			NOTES	
	ROUTE	DELAY	GROUND	TOTAL	POP.	DWELL.	SCHOOLS/	ON	OFF	TOTAL		
	SYSTEM		ACCESS		UNIT	HOSPITALS	AIRPORT	AIRPORT				
	-9-	-10-	-11-		-12-	-13-	-14-	-15-	-16-			
1	1630.7	5.9	28.4	1665.0	46,640	16,510	23	36,980	7,030	44,010	1/ SFO-San Francisco Airport OAK-Oakland Airport SJC-San Jose Airport NB-North Bay Airport	M.A.P. - Millions of Annual Pas- sengers
3a	1708.2	3.8	24.9	1736.9	45,640	16,480	18	35,420	7,700	43,120	2/ Annual hours of aircraft delay. Demand/Capacity ratio.	*1997 IFR **1997 VFR2 Demand/ Capacity ratio.
1	1845.5	10.8	33.0	1889.3	61,400	21,510	24	39,820	7,840	47,660	3/ Average ground travel distance for all air passengers-miles.	
2	1930.2	7.5	31.1	1968.8	57,720	20,140	25	39,120	8,220	47,340	4/ Annual Vehicle Miles of Travel for Air Pas- sengers-millions.	
3a	1946.7	5.7	28.8	1981.2	57,860	20,960	22	37,600	8,490	46,090	5/ Annual Vehicle Miles of Travel for Airport Em- ployees-millions.	
3b	1949.5	5.3	27.5	1982.3	55,940	20,370	22	38,400	8,510	46,990	6/ Tons per day of Hydrocarbons (HC) and Nitrogen Oxides (NOx).	
4a	1938.7	6.1	28.3	1973.1	56,800	20,440	26	39,350	8,400	47,750	7/ Tons per day of Hydrocarbons (HC) and Nitrogen Oxides (NOx). Includes air passengers and employees.	
											8/ Percent of regional emissions inventory at- tributed to aviation. Based on Air Quality Management Plan projections.	
											9/ Millions of equivalent gallons of fuel used by aircraft in flight annually.	
											10/ Millions of equivalent gallons of fuel used in delays to aircraft annually.	
											11/ Millions of equivalent gallons of fuel used in ground access to airports annually.	
											12/ Estimated population within 65 CNEL Contour.	
											13/ Estimated number of dwelling units within 65 CNEL Contour.	
											14/ Estimated number of schools and hospitals within 65 CNEL Contour.	
											15/ From ABAG <u>Airport Employment Projections and Impacts.</u>	
											16/ From ABAG <u>Airport Employment Projections and Impacts.</u>	

Table II-1

1997 SUMMARY COMPARISON OF AIRPORT SYSTEM ALTERNATIVES

YEAR	FORE-CAST RANGE	ALT.	DESCRIPTION	AIRPORT ALLOCATIONS (M.A.P.)		ANNUAL AIRCRAFT OPERATIONS	ANNUAL AIR CARRIER DELAY	AIRPORT GROUND ACCESS			AIR QUALITY EMISSIONS			
								AVE. DIST.	PASS. VMT	EMP. VMT	AIRCRAFT	AUTO	TOTAL	% REGION
NOTES				-1-			-2-	-3-	-4-	-5-	-6-	-7-		-8-
1997	LOW	1	<u>Existing Airport Shares</u> Passenger distribution among airports same as base year. Service concentrated at SFO	SFO	35.0	428,560	19,930	23.2	851	305	7.6	8.8	16.4	.9
				OAK	4.4									
				SJC	5.6									
				TOT	45.0									
		2	<u>Airline Plan</u> - Airlines emphasize new service at OAK as SFO approaches 31 MAP	SFO	31.0	430,660	11,750	21.1	799	300	7.7	8.5	16.2	.9
				OAK	8.4									
				SJC	5.6									
				TOT	45.0									
	HIGH	3a	<u>Regional Airport Plan</u> OAK and SJC serve much larger share of local passengers	SFO	27.0	437,760	9,350	19.5	750	292	7.7	8.1	15.8	.9
				OAK	10.0									
				SJC	8.0									
				TOT	45.0									
		1	<u>Existing Airport Shares</u> Passenger distribution among airports same as base year. Service concentrated at SFO	SFO	43.6	511,910	49,890	23.2	1059	339	9.1	11.1	20.2	1.1
				OAK	5.5									
				SJC	6.9									
				TOT	56.0									
		3a	<u>Regional Airport Plan</u> OAK and SJC serve much larger share of local passengers	SFO	32.2	527,590	15,800	19.3	921	325	9.4	10.1	19.5	1.1
				OAK	13.8									
				SJC	10.0									
				TOT	56.0									
		3b	<u>Regional Airport Plan/</u> <u>North Bay</u> - Same as 3a except limited intra-state service added in North Bay	SFO	31.0	532,480	13,900	18.5	892	324	9.4	9.8	19.2	1.1
				OAK	13.0									
				SJC	10.0									
				NB	2.0									
				TOT	56.0									
		4a	<u>SJC Constrained - Overflow to SFO - SJC limited to 8.0 MAP.</u> Overflow to SFO.	SFO	33.0	505,630	15,500	19.6	941	327	9.4	10.2	19.6	1.1
				OAK	13.0									
				SJC	8.0									
				NB	2.0									
				TOT	56.0									
		4b	<u>SJC Constrained - Overflow to OAK - SJC limited to 8.0 MAP.</u> Overflow to OAK.	SFO	31.0	530,040	14,700	19.6	951	325	9.4	10.2	19.6	1.1
				OAK	15.0									
				SJC	8.0									
				NB	2.0									
				TOT	56.0									

Table II-1

1997 SUMMARY COMPARISON OF AIRPORT SYSTEM ALTERNATIVES (CONT.)

ALT.	ENERGY USE				NOISE			AIRPORT EMPLOYMENT			NOTES
	ROUTE SYSTEM -9-	DELAY -10-	GROUND ACCESS -11-	TOTAL	POP. -12-	DWELL. UNIT -13-	SCHOOLS/ HOSPITALS -14-	ON AIRPORT -15-	OFF AIRPORT -16-	TOTAL	
1	1789.9	10.8	33.5	1834.2	43,400	14,980	14	40,190	8,630	48,820	1/ SFO-San Francisco Airport M.A.P. - Millions OAK-Oakland Airport of Annual Pas- SJC-San Jose Airport sengers NB-North Bay Airport
2	1863.0	6.3	29.6	1898.9	39,700	13,750	11	38,860	9,310	48,170	2/ Annual hours of aircraft delay. *1997 IFR Demand/Capacity ratio. **1997 VFR2 Demand/ Capacity ratio.
3a	1869.2	4.9	27.8	1901.9	37,890	13,270	14	37,770	9,720	47,490	3/ Average ground travel distance for all air passengers-miles.
1	2129.0	27.4	39.2	2195.6	56,620	19,430	24	44,850	11,290	56,140	4/ Annual Vehicle Miles of Travel for Air Pas- sengers-millions. 5/ Annual Vehicle Miles of Travel for Airport Employees-millions.
3a	2264.0	8.3	34.1	2306.4	46,820	16,410	16	41,670	12,440	54,110	6/ Tons per day of Hydrocarbons (HC) and Nitrogen Oxides (NO _x). 7/ Tons per day of Hydrocarbons (HC) and Nitrogen Oxides (NO _x). Includes air pas- sengers and employees.
3b	2268.7	7.3	33.1	2309.1	45,180	15,920	16	41,770	12,440	54,210	8/ Percent of regional emissions inventory attri- buted to aviation. Based on Air Quality Management Plan data.
4a	2262.2	8.3	34.8	2305.3	46,340	16,140	17	42,240	12,150	54,390	9/ Millions of equivalent gallons of fuel used by aircraft in flight annually.
4b	2278.9	7.6	35.2	2321.7	45,040	15,940	17	41,630	12,090	53,720	10/ Millions of equivalent gallons of fuel used in delays to aircraft annually. 11/ Millions of equivalent gallons of fuel used in ground access to airports annually.
											12/ Estimated population within 65 CNEL Contour. 13/ Estimated number of dwelling units within 65 CNEL Contour. 14/ Estimated number of schools and hospitals within CNEL Contour. 15/ From ABAG Airport Employment Projections and Impacts. 16/ From ABAG Airport Employment Projections and Impacts.

Table II-1
1997 SUMMARY COMPARISON OF AIRPORT SYSTEM ALTERNATIVES

YEAR	FORE-CAST RANGE	ALT.	DESCRIPTION	AIRPORT		ANNUAL AIRCRAFT OPERATIONS	ANNUAL AIR CARRIER DELAY	AIRPORT GROUND ACCESS			AIR QUALITY EMISSIONS			
				ALLOCATIONS (M.A.P.)				AVE. DIST.	PASS. VMT	EMP. VMT	AIRCRAFT	AUTO	TOTAL	% REGION
NOTES			-1-				-2-	-3-	-4-	-5-	-6-	-7-	-8-	
1997	HIGH	4c	Limit SJC - Expand North Bay - SJC limited to 8.0 MAP. SFO and OAK limited to 31.0 and 13.0 MAP. Domestic service expanded in North Bay	SFO	34.0	530,120	18,600	20.3	981	324	9.4	10.4	19.8	1.1
			OAK	10.0										
			SJC	8.0										
			NB	4.0										
			TOT	56.0										
		4d	Limit SJC - Overflow to Existing Airports. SJC limited to 8.0 MAP. No service in North Bay	SFO	33.0	524,610	17,100	20.6	995	325	9.4	10.6	20.0	1.1
OAK	15.0													
SJC	8.0													
NB														
				TOT	56.0									

Table II-1

1997 SUMMARY COMPARISON OF AIRPORT SYSTEM ALTERNATIVES (CONT.)

ALT.	ROUTE SYSTEM	ENERGY USE			NOISE			AIRPORT EMPLOYMENT			NOTES
		DELAY	GROUND ACCESS	TOTAL	POP.	DWELL. UNIT	SCHOOLS/ HOSPITALS	ON AIRPORT	OFF AIRPORT	TOTAL	
	-9-	-10-	-11-		-12-	-13-	-14-	-15-	-16-		
4c	2290.0	10.5	36.3	2336.8	47,890	16,580	17	41,160	11,850	53,010	1/ SFO-San Francisco Airport M.A.P. - Millions OAK-Oakland Airport of Annual Pas- SJC-San Jose Airport sengers NB-North Bay Airport
4d	2249.4	9.1	36.8	2295.3	47,480	16,620	18	41,490	11,980	53,470	2/ Annual hours of aircraft delay. *1997 IFR Demand/Capacity ratio. **1997 VFR2 Demand/ Capacity ratio. 3/ Average ground travel distance for all air passengers-miles. 4/ Annual Vehicle Miles of Travel for Air Pas- sengers-millions. 5/ Annual Vehicle Miles of Travel for Airport Employees-millions. 6/ Tons per day of Hydrocarbons (HC) and Nitrogen Oxides (NO _x). 7/ Tons per day of Hydrocarbons (HC) and Nitro- gen Oxides (NO _x). Includes air passengers and employees. 8/ Percent of regional emissions inventory at- tributed to aviation. Based on Air Quality Management Plan data. 9/ Millions of equivalent gallons of fuel used by aircraft in flight annually. 10/ Millions of equivalent gallons of fuel used in delays to aircraft annually. 11/ Millions of equivalent gallons of fuel used in ground access to airports annually. 12/ Estimated population within 65 CNEL Corridor. 13/ Estimated number of dwelling units within 65 CNEL Corridor. 14/ Estimated number of schools and hospitals within 65 CNEL Corridor. 15/ From ABAG <u>Airport Employment Projections and Impacts.</u> 16/ From ABAG <u>Airport Employment Projections and Impacts.</u>

III. POLICIES AND RECOMMENDATIONS

This section presents the goal, objectives, policies, and recommendations developed during the course of the Regional Airport Plan Update Program. The goal is a single statement describing what the plan seeks to accomplish. The objectives define the scope of work for the update study. Policies provide the key to implementing the plan by describing general guidelines for future decisions. Finally, the recommendations translate findings from the study into specific suggestions within the framework of the preceding policies.

Goal

To plan and coordinate the development of a safe, convenient, and environmentally acceptable system of airports in the Bay Area that satisfies a range of regional and community needs.

Objectives

- 1.1 Develop support and concurrence for the Regional Airport Plan at all levels of government.
- 1.2 Develop explicit policies to guide the implementation of the regional plan. These policies should be arranged in a series of stages whereby a more direct, active regional role is called for if progress towards plan implementation is not made through more cooperative means.
- 1.3 Reassess future passenger and air cargo demand based on new information concerning airline deregulation, fares, energy availability, economic conditions, etc.
- 1.4 Develop methods to better match aviation demand with the supply of ground access, airport and airspace capacity.
- 1.5 Develop methods to expand the role of private and public transit and high occupancy vehicles in providing new ground access capacity to airports.
- 1.6 Develop a strategy for controlling and abating aircraft noise in the region.
- 1.7 Review the impact of airport activity on regional and local air quality conditions and recommend appropriate mitigation measures.
- 1.8 Review the impact of regional recommendations on energy consumption and conservation concerns and recommend appropriate mitigation measures.

- 1.9 Review the need for filling of the Bay to a) provide additional airport system capacity, or b) provide noise abatement. (The position of the Bay Conservation and Development Commission is that aircraft noise should not alone constitute a reason to fill the Bay)
- 2.0 Develop methods to coordinate future capital investments with regional development priorities.

Policies

● General

- 1.1 The Regional Airport Plan as it is adopted and amended will serve as the Airport Element of ABAG's Regional Plan and MTC's Regional Transportation Plan.
- 1.2 The planning and development of the regional airport system shall be an integral part of the regional transportation system and shall be coordinated with Federal, State, regional and local levels of government. To the extent possible, the planning process shall identify and help resolve conflicts between various jurisdictions, plans, and policies.
- 1.3 The regional airport system shall be planned to provide a convenient and safe system for its users and to minimize airspace conflict and delay.
- 1.4 The regional airport system shall be developed and operated in a manner that shall minimize noise and air pollution in sensitive and populated areas. Development of the system shall also be planned to minimize disruption of wildlife habitats, tidelands and the Bay.

● Plan Implementation

- 1.1 Development of additional airport system capacity at the Bay Area airports shall be consistent with the recommendations in the Regional Airport Plan.
- 1.2 Cooperation from the airline industry shall be requested in implementing service development proposals in the regional plan.
- 1.3 The Regional Airport Planning Committee shall also explore operational, institutional and economic methods for achieving airline service development objectives.
- 1.4 In proposing new strategies for traffic distribution, concurrence from local Bay Area communities shall be requested.

- 1.5 The ultimate role of a North Bay airport shall be determined through a cooperative study involving ABAG, MTC, BCDC, and the North Bay communities.

● Airport Noise

- 1.1 Current limitations on cumulative airport noise in residential areas contained in the California Airport Noise Standards should be retained.
- 1.2 Compliance of airports with the State's Airport Noise Standards shall be the goal for all airports in the region; however, in recognition of the difficult task of reaching this goal, reasonable and continuing progress shall be used as a criterion for regional decision making.
- 1.3 The regional noise allocations for each airport as adopted and revised by the Regional Airport Planning Committee shall be used as a guide for assessing reasonable and continuing progress. The capability of the airlines to provide expanded service in the Bay Area will be constrained by the industry's ability to perform within these guidelines.
- 1.4 At airports surrounded by substantial existing development, every effort shall be made to control airport noise through on-airport actions.
- 1.5 Airport noise abatement plans should specifically consider the need to mitigate loud single events, particularly those occurring in the late evening.
- 1.6 In order to resolve residual noise impacts -- those existing or projected impacts remaining after application of all reasonable on-airport measures -- a cooperative and continuing program shall be established between the airports and local communities to achieve land use compatibility.
- 1.7 "In-fill" of vacant land shall be permitted in existing or projected noise impact areas only when a) noise insulation is incorporated in new construction and is designed to reduce the maximum anticipated outside noise level for the project area (either existing or future, whichever is greater) to acceptable interior levels, and b) noise easements are concurrently provided to the airport.
- 1.8 Noise insulation and noise easements should not be used as a means to achieve compliance with the State's noise standards for large new developments in proximity to existing or proposed airports.
- 1.9 Legislation that would substantially delay the Federal compliance schedule for retirement of aircraft that do not meet FAR Part 36 noise certification standards should be opposed.

- 2.0 Air traffic routings and procedures shall place a high priority on reducing aircraft noise including "overflight" noise at higher altitudes. Changes in flight procedures that result in a shift in noise levels from one part of the Bay Area to another should be coordinated with regional agencies and local jurisdictions.
- 2.1 Land around Hamilton AFB, Sonoma County Airport, Napa County Airport, and Travis AFB shall be maintained in compatible use until such time as the policy concerning the potential for limited intrastate service is clarified in the regional plan.
- 2.2 The land use interpretations of the State Office of Noise Control are adopted as the basis for determining airport/community noise compatibility relationships.

● Airspace

- 1.1 Slot allocations and/or user fees are endorsed as a means to rationalize airport and airspace use when air traffic delays approach or regularly exceed acceptable levels.
- 1.2 Priorities for use of airports and airspace by air carriers, general aviation and the military shall be established based on air safety, the need for access to a specific airport, and the potential for using alternate facilities.
- 1.3 Separate Instrument Landing System (ILS) facilities shall be developed for exclusive use by general aviation. Separate general aviation facilities shall be developed at the major airports where practicable.
- 1.4 The establishment of Terminal Control Areas (TCA's) and Terminal Radar Service Areas (TRSA's) shall be the minimum necessary to assure safety and shall provide for adequate visual flight into and out of the Bay Area.

● Ground Access to Airports

- 1.1 Ground transportation facilities and services shall be planned and programmed to reinforce the role of each airport in the regional plan.
- 1.2 Provisions for new ground access capacity to Bay Area airports shall place maximum reliance on the use of public and private transit services and high occupancy vehicles.
- 1.3 Transportation shall be provided between airport terminals to maximize convenience for the passenger and facilitate the redistribution of airline flights.
- 1.4 The long range goal of transportation development programs at all airports shall be to serve a minimum of 25% of the air

passenger and airport employee trips by transit.* Staged transit ridership goals shall be established at each airport in accordance with the requirements for preparation of transportation development programs.

- 1.5 Provision of on-airport transportation facilities (e.g., access roads and parking space) shall be consistent with airport transit ridership goals.
- 1.6 Airports shall study means to provide preferential treatment for transit adjacent to and on airport property.
- 1.7 Transportation programs for airport employees shall include the development of ride-sharing programs.
- 1.8 Airport development plans shall consider ground access requirements and appropriate ground access projects shall be included in the Regional Transportation Improvement Program prior to expansion of the airport.

● Energy Conservation

- 1.1 The airline industry shall attempt to maintain a minimum annualized load factor of 60%.
- 1.2 In any future allocation of energy supplies, essential air transportation services from the Bay Area shall be protected and preserved.
- 1.3 A reduction in intra-Bay airline operations is encouraged for energy conservation purposes.
- 1.4 Energy conservation shall be considered in the routing of aircraft into and out of the Bay Area.

● Air Quality

- 1.1 Combined airport and background emissions shall not exceed Federal or State standards in any areas off the airport where people normally live or work. Required reductions in airport emissions shall be in proportion to the airport's contribution to total emissions at the location of the exceedance.
- 1.2 A continuing program for reducing aircraft engine emissions as recommended by the EPA should be implemented.

● Project Review

- 1.1 Airport development plans shall be coordinated with Federal, State and local agencies.

*Transit is defined to include all vehicles carrying 14 or more passengers.

- 1.2 The preparation of appropriate airport noise abatement programs, ground transportation development programs, and air quality improvement programs is required for favorable action on regionally significant projects submitted for regional review.* Regionally significant projects are those that expand airport capacity or have major adverse impacts on the environment.
- 1.3 Specific mitigation measures shall be included as part of an airport expansion project in the event there is unavoidable environmental disruption.

● Policy for Airline Service at a New Location

- 1.1 Development of new airline service and facilities at airports not currently receiving service shall be planned and coordinated with local jurisdictions.
- 1.2 No new airline facility shall be developed with public funds unless a plan exists to assure the continued use of the facility and recovery of public investment.
- 1.3 Provision of adequate ground access facilities shall be a prerequisite for development of airline service at a new location. Transit ridership goals shall be established.
- 1.4 Airport sites that enhance airspace efficiency shall receive a high priority.
- 1.5 Initiation of airline service at a new location shall require that the airport be able to meet the January 1, 1986 State Airport Noise Standards.
- 1.6 Acquisition of land for potential new airport sites shall include sufficient land to meet the 65 CNEL criterion level for traffic allocated to the airport in the regional plan.
- 1.7 Evaluation of new airport sites shall include an air quality assessment.

● Financing of Capital Improvements and Other Programs

- 1.1 Continuation of the aviation Trust Fund is supported. Monies accumulated in the Trust Fund should be available to all Bay Area air carrier airports.
- 1.2 A five year Transportation Improvement Program should be developed for air carrier airports in the region and coordinated with the regional agencies. The apportionment of money to a Bay Area "hub" fund rather than individual airports is endorsed.

*Office of Management and Budget Circular A-95 or California Government Code Section 66520.

- 1.3 Use of a passenger facility charge should be considered as a means to provide matching money for federal aid, and to finance airport ground access projects and residential noise insulation programs.

Plan Recommendations

- **Regional Forecasts** - Airport facilities in the Bay Area will be required to handle 37 to 43 million annual passengers by 1987 and 45 to 56 million annual passengers by 1997. Air cargo volumes will grow to 790 to 838 thousand tons in 1987 and 1,284 to 1,784 thousand tons in 1997. The uncertainty as to exactly when these levels will be reached is reflected in the adoption of a variable time window of +2 years in 1987 and +3 years in 1997. For example, the actual passenger "forecast" is:

<u>Forecast</u>	<u>Time Variation</u>	<u>Demand Variation</u>
"1987" Forecast	1985-1989	37,000,000-43,000,000 annual passengers
"1997" Forecast	1994-2000	45,000,000-56,000,000 annual passengers

- **Annual Traffic Allocations** - The allocation of traffic shown in Table III-1 shall be used to guide development of airline service and facilities in the Bay Area.
- **Statement of Airport Roles**

San Francisco International Airport:

San Francisco Airport will continue in its role as the major supplier of airline service for the region. Most air cargo and international flights will remain at San Francisco Airport, as will the region's connecting passenger traffic. The rate of passenger growth will, however, gradually decrease as new airline service is provided at other Bay Area airports. The policy limit of 31 million annual passengers is retained because of the need to control and abate airport noise, because of deficiencies in airport landside capacity and because of the need to better utilize airport and airspace capacity in the Bay Area. Prior to reaching this limit, agreements shall be developed among Bay Area airport operators and local communities with respect to the distribution of future airline service in the Bay Area. Cooperation will also be required from the airline industry.

Metropolitan Oakland International Airport:

Air service at Oakland will be expanded and improved in order to accommodate a larger share of future Bay Area traffic. Most new airline service will be domestic; however, some international service will also be developed. In addition to serving the East Bay, Oakland Airport will also relieve San Francisco Airport by

Table III-1
RECOMMENDED REGIONAL TRAFFIC ALLOCATIONS

1977 Conditions

Airport	Passengers*		Aircraft Movements		PPO**	Air Cargo Tons	
	Millions	% Region	Thousands	% Region		Thousands	% Region
San Francisco	18.9	77.3%	256.3	71.6%	81.2	470.0	95.9%
Oakland	2.5	10.2	43.7	12.2	57.7	7.9	1.6
San Jose	<u>3.1</u>	<u>12.5</u>	<u>58.0</u>	<u>16.2</u>	<u>53.7</u>	<u>12.2</u>	<u>2.5</u>
Total	24.5	100.0%	358.0	100.0%	73.5	490.1	100.0%

1987 - Low Forecast

Airport	Passengers*		Aircraft Movements		PPO**	Air Cargo Tons	
	Millions	% Region	Thousands	% Region		Thousands	% Region
San Francisco	24.0	64.9%	248.3	58.7%	104.1	717	90.8%
Oakland	7.0	18.9	89.4	21.1	80.3	40	5.0
San Jose	<u>6.0</u>	<u>16.2</u>	<u>85.6</u>	<u>20.2</u>	<u>71.0</u>	<u>33</u>	<u>4.2</u>
Total	37.0	100.0%	423.3	100.0%	92.0	790	100.0%

1987 - High Forecast

Airport	Passengers*		Aircraft Movements		PPO**	Air Cargo Tons	
	Millions	% Region	Thousands	% Region		Thousands	% Region
San Francisco	27.0	62.8%	271.2	56.0%	107.2	756	90.2%
Oakland	8.0	18.6	104.0	21.4	80.3	43	5.1
San Jose	7.0	16.3	97.8	20.2	72.6	36	4.3
North Bay	<u>1.0</u>	<u>2.3</u>	<u>11.7</u>	<u>2.4</u>	<u>85.6</u>	<u>3</u>	<u>.4</u>
Total	43.0	100.0%	484.7	100.0%	93.6	838	100.0%

1997 - Low Forecast

Airport	Passengers*		Aircraft Movements		PPO**	Air Cargo Tons	
	Millions	% Region	Thousands	% Region		Thousands	% Region
San Francisco	27.0	60.0%	257.4	58.8%	113.3	1,137	88.5%
Oakland	10.0	22.2	98.6	22.5	106.1	87	6.8
San Jose	<u>8.0</u>	<u>17.8</u>	<u>81.8</u>	<u>18.7</u>	<u>99.6</u>	<u>60</u>	<u>4.7</u>
Total	45.0	100.0%	437.8	100.0%	109.0	1,284	100.0%

Table III-1 (cont'd)
1997 - High Forecast

Airport	Passengers*		Aircraft Movements		PPO**	Air Cargo Tons	
	Millions	% Region	Thousands	% Region		Thousands	% Region
San Francisco	31.0	55.4%	281.9	52.9%	118.9	1,524	85.4%
Oakland	13.0	23.2	126.5	23.8	107.4	150	8.4
San Jose	10.0	17.8	102.2	19.2	99.6	105	5.9
North Bay	<u>2.0</u>	<u>3.6</u>	<u>21.9</u>	<u>4.1</u>	<u>91.3</u>	<u>5</u>	<u>.4</u>
Total	56.0	100.0%	532.5	100.0%	111.1	1,784	100.0%

*On and off passengers. Includes "connecting" passengers but excludes "through" passengers.

**Passengers per Operation (excludes Charter, non revenue, and air cargo flights; also excludes "through" passengers).

providing convenient ground transportation for passengers with destinations in downtown San Francisco. New airline service, as well as improved ground transportation, will enhance the attractiveness of Oakland for resident and visiting air travelers and for the airline industry. Other direct benefits from using Oakland will be reduced airspace delays and limited noise restrictions due to the availability of overwater approaches and departures. Air cargo will also increase as a result of expanded domestic service. Oakland's traffic can be accommodated on a single runway. Oakland's North Airport could also serve as a major feeder airport for third level airlines thus relieving air carrier facilities in the region.

San Jose Municipal Airport:

Continuing development in the South Bay will place pressures on San Jose Airport to provide expanded airline facilities. Local demand that cannot be served at San Jose Airport will add to airport noise and traffic problems at other airports in the Bay Area. New service will be selectively increased to major domestic markets; however, the supply of new service will be controlled by airport noise abatement policies. Traffic growth may have to be constrained in the short-range due to the limited availability of new noise technology aircraft; however, the potential for handling up to 10 million annual passengers exists in the long-range with advanced aircraft versions in service. Development of local transit services needs to be stressed because of congestion on surrounding freeways and the limited amount of airport land for new parking and circulation.

North Bay Airport:

Regional traffic allocations to the North Bay contemplate the introduction of limited intrastate service at one or more existing airports--Hamilton AFB, Sonoma County, Napa County, or Travis AFB (Joint Use).^{*} In addition to the convenience for the local air traveler, the placement of new airline service in the North Bay would provide an incremental measure of noise relief for communities around other Bay Area airports and also provide some reduction in airspace delays. The volume of passengers attracted depends on the specific airport location. The decision to recommend such service is primarily a local determination based on the air service benefits and community impacts. However, the long-range regional impacts on other airports in the Bay Area and on communities in the North Bay are sufficient to warrant a cooperative study of aviation requirements in this area. Such a study would involve ABAG, MTC, BCDC, and local North Bay jurisdictions.

^{*}As noted in the earlier Regional Airport System Study, Travis AFB could play a larger role in the regional system by accommodating overflow from the other Bay Area airports.

- **Plan and Project Review** - One of the key actions taken during the update program was the adoption of criteria to be used in evaluating future airport improvement projects that are classified "regionally significant." Projects would normally be classified regionally significant as a result of their anticipated effects on airport system capacity or the environment. By resolution* ABAG and MTC indicated that they would not "favorably review and recommend approval of future grant application unless, among other things, there is evidence that the Airport has an effective noise abatement program, an effective ground transportation development program, and an effective air quality improvement program as necessary, all of which are in accord with RTP (Regional Transportation Plan) objectives, and only where the Airport has taken, and is taking, action to achieve demonstrable progress in the following specific areas which are of concern...

- 1) Evidence from the Airport's noise monitoring system that the trend in Airport noise is such that future Airport noise levels will not exceed the noise levels calculated under the Regional Airport Plan Update Program for the traffic allocation shown in the Regional Transportation Plan.
- 2) Evidence that the Airport has, in cooperation with local jurisdictions, developed a plan for reducing the amount of incompatible land within the 65 CNEL contours calculated above.
- 3) Evidence that the Airport has achieved the 25 percent transit capacity goal contained in the Regional Transportation Plan; or evidence that the Airport is taking all appropriate actions to assure that transit capacity and ridership is increasing as shown by periodic reports from the transit operators serving the Airport, and evidence that a target date has been established by which the Airport expects to realize the 25 percent goal contained in the Regional Transportation Plan.
- 4) Evidence that the Airport has embarked on an effective program to develop the use of mass transit service and to provide incentives for Airport passengers and employees to use mass or pooled transportation, including such measures as:
 - a. Installation of transit information facilities and programs in terminals which are readily available to passengers;

*See for example, MTC Resolution 592, "Policies for Review of Future Requests for Federal or State Aid by Bay Area Airports."

- b. Programs which will provide convenient facilities which make mass transit services attractive to passengers and Airport employees;
 - c. Programs to encourage car pooling or van pooling among Airport employees;
 - d. Programs through which the Airport takes a leadership role in recommending improvements to existing transit services and scheduling.
- 5) Evidence that air pollution generated at the Airport is within applicable Federal and State standards or that specific measures are being taken to reduce pollution levels as rapidly as possible...."

The purpose of these recommendations is to provide criteria to the Airports so that they will be fully apprised in advance of the basis for future actions on grant applications submitted for regional review under Office of Management and Budget Circular A-95 and California Government Code Section 66520.

- **Airport Noise Allocations** - One of the key recommendations resulting from the plan update program concerns the regional airport noise allocation system. This recommendation establishes a noise "budget" for each airport based on the airport's share of traffic in the Regional Airport Plan. In developing the noise budget, it has been assumed that all aircraft using the Bay Area airports will meet Federal Aviation Regulations - Part 36 aircraft noise certification requirements by 1987.

Such a budget provides a regional framework for airport noise abatement while allowing airport operators considerable latitude in developing appropriate local control strategies for achieving these goals. More stringent goals established as a result of airport/community land use compatibility studies are consistent with the spirit and intent of the regional noise allocation recommendation. In particular, the San Francisco/San Mateo Joint Land Use Study has developed an Action Plan that could lower the number of dwelling units within the 1986 65 CNEL contour to 7500 units.

The major elements of a workable system include the following:

- 1) A commitment by Bay Area airports to participate in the regional noise allocation system;
- 2) An agreement with each operator as to how much "credit" will be given towards the noise budget for sound treatment of residences surrounding the airport;

*Airport noise in residential areas must not exceed 70 CNEL by January 1, 1981 and 65 CNEL by January 1, 1996.

- 3) A method for developing noise contours on regular basis, such that noise monitoring data is used to generate accurate contours which are then transferred to a land use map to determine the number of dwelling units impacted.

The relationship of airport noise levels to the airport's noise allocation shall be reviewed by ABAG and MTC in evaluating future requests for Federal airport development funds and for commenting on future requests for variances from the State Noise Standards.

The noise budget is defined in terms of the number of dwelling units within the projected 65 CNEL noise contour at each airport. Interim budgets for critical compliance dates under the California Airport Noise Standards are established on a straight line basis from 1976 noise levels. (It should be pointed out that the initial focus of such a system is on controlling airport noise levels without considering the extent to which this noise has been mitigated by sound treatment of residences and/or purchase of noise easements off the airport. From a conceptual viewpoint, correction of incompatible land uses off the airport is considered a separate and independent action required to achieve further compliance with the State Noise Standards.)

A further specific recommendation has to do with potential new runways at San Francisco Airport for noise abatement. In this regard, construction of new runways in the Bay at San Francisco Airport for noise abatement purposes shall not be considered a high priority while other Bay Area airports are underutilized or serve only a portion of the traffic allocated to them in the regional plan.

REGIONAL AIRPORT NOISE ALLOCATION
(Projected Dwelling Units Within 65 CNEL Contour)

<u>Airport</u>	<u>1976</u>	<u>1981*</u>	<u>1986*</u>	<u>1987</u>	<u>1997</u>
San Francisco	12,000	10,690	8,970	8,630	8,630
Oakland	80	1,730	3,390	3,720**	3,320
San Jose	<u>1,630***</u>	<u>3,800</u>	<u>5,970</u>	<u>6,400</u>	<u>2,990</u>
Regional Total	14,110	16,220	18,370	18,750	15,920

*Interpolated on straight line basis for years when State Airport Noise Standards change to more stringent criterion.

**Assumes departure routes are modified to eliminate noise impacts in north Alameda.

***Based on 1975 noise contour.

- **Airport Financing** - The formula for apportioning money from the Federal aviation Trust Fund should be revised. Under existing legislation, funds are apportioned directly to individual airports based on the number of "enplaned" passengers. This formula does not recognize future airport development needs or changing development priorities within a system of airports. It is therefore recommended that a revised method of apportioning funds be developed for areas where there is an adopted regional airport system plan. A single enplanement fund should be created for the region based on enplanements of all airports comprising the regional system. A five year Transportation Improvement Program should be prepared cooperatively by the airport operators and regional agencies and submitted annually to the Federal Aviation Administration. Federal funds should be apportioned to the Bay Area airports based on the program submitted.

The need for a "head tax" or passenger facility charge should also be considered in developing airport financing recommendations. In order for Bay Area airports to meet future demands, improved ground transportation facilities will be required. Also, to provide greater community compatibility, airports may be required to initiate major residential sound treatment programs. There are no direct sources of funds for such programs. A "passenger facility charge" would produce a direct user based fee to help finance these programs. At Oakland and San Jose Airports, revenues from such a charge could also be used to augment local matching funds for Federal grants (it should be noted that the "head tax" has been prohibited by Congress since 1973 and would therefore require congressional approval).

- **Institutions** - One of the key areas requiring further regional review is the potential for affecting institutional changes in the way the Bay Area airports are managed and operated. While there are certainly a number of key economic and proprietary questions that should be carefully studied, a regional approach to managing air traffic demand, coordinating the development of new airline service and expanding facilities at the major Bay Area airports should be evaluated and implemented if feasible. Attention should be directed at concepts that a) build on existing institutional arrangements, b) are not discriminatory or anti-competitive, c) do not burden interstate commerce, d) generally support the spirit and intent of the Airline Deregulation Act, and e) have support from local Bay Area communities.
- **Other Proposals** - The Regional Airport Planning Committee has also adopted a series of proposals to foster a more efficient and environmentally acceptable airport system. These proposals are summarized in Table III-2. They are more specific in nature than the recommendations; however, a number of the proposals require additional review and analysis.

SUMMARY OF PROPOSALS

PROPOSALS	TIME FRAME*			LEAD AGENCY	REGIONAL ROLE	COMMENTS
	S	M	L			
<u>FORECASTS/DATA</u>						
1. Review forecasts.	●	●	●	RAPC	Review forecasts.	Regional forecasts should be reviewed every two years. Incremental adjustments should be made considering current regional population, employment and income projections, local and national economic trends, air fares, regulatory changes, and energy availability.
2. Conduct Air Passenger Survey.	●	●	●	RAPC	Design & manage survey.	Data on passenger origins/destinations, ground access patterns, etc., should be updated every five years.
3. Develop consistency in monthly Activity Reports.	●			RAPC	Suggest changes.	Airports should review format for reporting monthly passenger, cargo, and flight statistics to develop consistent reporting format.
<u>AIRPORT SYSTEM ALTERNATIVES</u>						
1. North Bay - Conduct cooperative study with local jurisdictions to develop recommendations for serving future North Bay passenger demand.	●			RAPC	Determine interest. Develop work scope. Manage study.	Existing policy calls for cooperative study addressing a range of issues. (Comparative data on effect of North Bay airport on regional plan developed as part of plan update study.)
2. Evaluate methods to coordinate operation of airports as a regional system.	●			RAPC	Determine interest. Develop work scope. Manage study.	Study would evaluate operational and institutional methods for integrating Bay Area airports. Operational methods include helicopter, STOL, watercraft, bus or fixed guideway transit system. Institutional methods include combined airport management, flight allocation committee, airport pricing committee, etc.
*S = Short-range (0-5 years) M = Medium-range (5-10 years) L = Long-range (10-20 years)						

Table III-2 (Con't)

SUMMARY OF PROPOSALS

PROPOSALS	TIME FRAME			LEAD AGENCY	REGIONAL ROLE	COMMENTS
	S	M	L			
3. Evaluate second Oakland runway and alternatives.		●		RAPC BCDC	Evaluate alternatives.	A long-range issue remains concerning the need for a second runway in the Bay and alternatives to its construction.
<u>AIRPORT AND AIRSPACE CAPACITY</u>						
1. Evaluate potential for rescheduling flights.		●		FAA Airlines	Evaluate system impact from rescheduling.	When delays start to regularly approach acceptable limits, encourage airlines to cooperate in voluntary rescheduling of peak period flights.
2. Establish quota rule for SFO (FAR 93) and/or peak period surcharges.		●		FAA Airport		When delays start to regularly exceed acceptable limits, establish a quota for critical traffic periods at SFO or establish surcharges to encourage more rational use of capacity.
3. Segregate general aviation and commuter airline traffic at air carrier airports.		●		FAA		Evaluate potential for using separate airfield facilities and air traffic control procedures for general aviation and commuter airline traffic.
4. Develop "Reliever" general aviation airports that can be used during peak IFR demand periods.		●		FAA Airports	Approve funding.	To provide maximum benefit to the system, reliever airports should have an instrument approach and full ILS if possible.
5. Develop General Aviation ILS training capability.		●		FAA	A-95 review.	Installation of ILS at one or more airports, e.g., Livermore, Hollister, Tracy or Napa, could help satisfy ILS training demand in region and relieve air carrier airports.

SUMMARY OF PROPOSALS

PROPOSALS	TIME FRAME			LEAD AGENCY	REGIONAL ROLE	COMMENTS
	S	M	L			
6. Construct airfield improvements to reduce delays.	●	●	●	Airports	Approve funding.	Proposed projects to reduce delay should be evaluated for impact on airport capacity, noise, and Bay fill.
7. Establish inter-airport transfer capability (air, water or ground).		●		Airports Transit operators	Evaluate funding sources.	Ability of airlines to land at either OAK or SFO and return passengers and bags quickly to desired terminal would enhance airspace capacity (e.g., during IFR weather).
8. Conduct detailed airspace investigation.	●			FAA	Suggest and support.	Large delays are projected, possibly as early as 1987. Studies should be conducted now by FAA to quantify delays, review impact of new ATC technology and evaluate methods to increase airspace capacity.

AIRPORT GROUND ACCESS

1. Prepare transportation development programs.	●	●	●	Airports	Required for A-95 review.	MTC Resolution 592 makes preparation of such programs a condition for favorable review of major expansion projects. Elements include transit coordination & leadership, transit ridership goals, preferential transit treatment on the airport, ride-sharing, paratransit, transit information, transportation system monitoring, etc.
2. SFO-Review I-380 Collector Ramp Project.	●			Caltrans Airport	Coordinate review.	The construction of I-380 Collector Ramp should be reviewed to determine that the project a) represents the best transportation improvement program on the airport for the money available, and b) does not foreclose any options for preferential facilities for transit/high occupancy vehicles.

Table III-2 (Con't)

SUMMARY OF PROPOSALS

PROPOSALS	TIME FRAME			LEAD AGENCY	REGIONAL ROLE	COMMENTS
	S	M	L			
3. SFO-Preserve options for direct BART service.	●	●		Airport	Evaluate BART extension.	Airport plans for west of Bayshore property should preserve future option for a BART station in this location. (Costs may be prohibitive for BART subway through garage as originally planned.)
4. SFO-Upgrade existing transit connections from BART and SP to airport.	●			SamTrans or BART	Suggest and co-ordinate.	Shuttle bus service similar to Oakland's Air-BART should be considered.
5. Expand area bus service.	●	●	●	Transit operators	Provide transit funds.	As demand increases, transit operators should consider 1) extended area coverage, 2) increased express service, 3) development of remote park-and-fly lots, 4) evaluating local streets for preferential use by airport transit services.
6. SFO-Encourage development of private transit services from remote areas.	●	●	●	Airport		Recognize importance of smaller operators in providing access from remote areas. Provide adequate curbspace and signing.
7. SFO-Open airport to local cab companies.	●			Airport		Opening airport to San Mateo cabs could replace a number of dropoff/pickup trips with single cab trips.
8. OAK-Design and evaluate BART connector system.	●	●		Airport	Approve funds.	Convenient connection to BART will enhance regional role of airport and improve ground access to OAK. Alternatives to fixed guideway system should also be studied to evaluate potential for staging service improvements and costs.

Table III-2 (Con't)

SUMMARY OF PROPOSALS

PROPOSALS	TIME FRAME			LEAD AGENCY	REGIONAL ROLE	COMMENTS
	S	M	L			
9. OAK-Improve local street access.		●	●	City of Oakland	Coordinate review. Program funds.	Major improvements to Hegenberger Road, 98th, and Davis St. will be needed to meet airport access requirements. Alternative access to the Industrial Park from 66th Ave. should be considered to relieve Hegenberger Rd.
10. OAK-Extend Hegenberger Expressway to I-580.		●		City of Oakland Caltrans	Program funds.	Project would provide improved access to airport from I-580 and to Coliseum and Eastmont shopping center. However, severe neighborhood problems exist.
11. OAK-Expand area transit service.	●	●	●			See 5.
12. SJC-Study extension of proposed light rail system to airport.	●			County Transit District	Review. Program funds.	County currently conducting a detailed alternatives analysis of light rail and other transit technologies as a prerequisite for funding possible County light rail system.
13. SJC-Program freeway interchange improvements.	●			City of San Jose/ Caltrans	Program funds.	Priorities for improvement of freeway interchanges serving airport should be established. High priority projects should be proposed for inclusion in the T.I.P.
14. SJC-Expand area bus service.		●		County Transit District		County plans to expand bus fleet. Improved airport service should be considered, including connection to BART.
15. SJC-Upgrade bus service to SFO/OAK.		●		Transit operators		Possible limits on SJC growth will increase transit demand to SFO/OAK.

Table III-2 (Con't)

SUMMARY OF PROPOSALS

PROPOSALS	TIME FRAME			LEAD AGENCY	REGIONAL ROLE	COMMENTS
	S	M	L			
16. Revise ADAP legislation to make airport access projects eligible.	●			RAPC	Review new ADAP legislation. Coordinate local response.	Transit and highway projects that primarily serve airport users should be eligible for aviation trust funds.
<u>AIRPORT NOISE</u>						
1. Prepare noise abatement programs.	●	●	●	Airport	Required for A-95 review. Request conditions on ADAP grant if necessary.	MTC/ABAG resolutions make preparation of such programs a condition for favorable review of major expansion projects. Regional agencies are also interested in evidence that noise trends are consistent with those projected in regional plan and that airports have, in cooperation with local jurisdictions, developed a plan for reducing incompatible land uses.
2. Adopt future noise allocations for airports.	●			RAPC	Review with airports.	Allocations are intended to a) establish goal for region and airports, b) guide future regional decisions, and c) provide airport operators flexibility in working out individual strategies. Allocations would be based on airport traffic distribution in regional plan.
3. Support legislation to ensure compliance with federal schedule for retrofitting, re-engineing, and replacing all non-Part 36 aircraft by January 1, 1985.	●	●		RAPC	Review legislation. Coordinate local response.	RAPC should support legislation that: 1) proposes user generated fees, if necessary, to finance compliance; 2) does not permit substantive deviation from Jan. 1, 1985 compliance date; 3) does not prohibit application of new technology to aircraft produced before availability of technology.

Table III-2 (Con't)

SUMMARY OF PROPOSALS

PROPOSALS	TIME FRAME			LEAD AGENCY	REGIONAL ROLE	COMMENTS
	S	M	L			
4. SFO-Implement Land Use Study recommendations.	●	●	●	Airport	Review and comment.	Major strategies being considered include: <ul style="list-style-type: none"> ● maximum aircraft noise levels by time of day ● noise quota system ● noise pricing system ● revised preferential runway system ● revised flight procedures ● new noise abatement runways
5. OAK-Review flight tracks over Alameda. Initiate actions to solve future land use compatibility problems on Bay Farm Island.		●	●	Airport FAA	Suggest action.	If noise begins to intrude on northern Alameda, FAA should consider reconfiguration of College 6 flight track. Greater use of Silent 1 between 7p.m. and 10p.m., where practical and safe, could help reduce noise on Bay Farm Island.
6. SJC-Implement airline/airport use agreement to control airport noise levels. Continue land acquisition program.	●	●	●	Airport Airlines	Approve ADAP funds for land acquisition program.	Agreement establishes right of City to regulate hours of airport operation. Airport should also consider incentives for airlines to use newest technology equipment and to reduce number of "fill up" flights also serving SFO/OAK.
7. North Bay-Review land use decisions affecting North Bay airports.	●			RAPC	A-95 review.	Land uses around Hamilton, Napa County, Sonoma County, and Travis Airports should be retained in uses compatible with limited air carrier operations until recommendations are made from joint North Bay Study.
8. Prepare Airport Land Use Compatibility Studies.	●	●	●	Airport	Review and comment.	Remedial programs to acquire, insulate, or offer voluntary relocation assistance to home owners should be reviewed with respect to projected noise levels in regional plan. Short term emphasis should be on 70 CNEL area for 1981.

Table III-2 (Con't)

SUMMARY OF PROPOSALS

PROPOSALS	TIME FRAME			LEAD AGENCY	REGIONAL ROLE	COMMENTS
	S	M	L			
9. Review ALUC plans and plans for major residential development.	●	●	●	RAPC	Review and comment.	ALUC plans and plans for major development should be reviewed for consistency with the regional plan in order to a)prevent an increase in incompatible use and b)facilitate a decrease in existing incompatible uses.
10. Support revised ALUC legislation.	●			RAPC	Propose new legislation. Coordinate local response.	RAPC should support legislation that: 1) recognizes state and regional plans in establishing noise impact boundaries; 2) provides mechanism for achieving consistency between ALUC and local plans; 3) provides mechanism for dealing with existing incompatible uses; 4) provides a linkage for sharing mitigation responsibility between airport and local communities.
11. Prepare quarterly noise maps/ Expand monitoring locations.	●			Airports	Update noise maps if not done by airports. Comment on proposed variances.	Airports should consider acquiring computer software to generate quarterly noise maps based on monitoring data. This capability would help to better identify the noise impact boundary and to evaluate potential mitigation measures. Additional monitors should be considered.
12. Assist in reviewing proposed flight track changes.	●	●	●	RAPC	Coordinate local resolution of issues.	When proposed flight pattern changes at one airport shift noise from one community to another, RAPC may be able to assist in resolution of conflict.
<u>AIR QUALITY</u>						
1. Prepare air quality improvement program.	●	●	●	Airports	Required for A-95 review.	MTC/ABAG resolutions have requested such programs be prepared when there is evidence that existing or projected air qual-

Table III-2 (Con't)

SUMMARY OF PROPOSALS

PROPOSALS	TIME FRAME			LEAD AGENCY	REGIONAL ROLE	COMMENTS
	S	M	L			
						ity conditions exceed State and Federal standards.
2. Reduce emission rates for aircraft engines.	●	●		EPA	Support changes in regulations.	Proposed changes by EPA to aircraft engine emission standards would significantly lower emissions. Engine manufacturers must produce the technology.
3. Increase use of mass transit and shared-ride programs.	●	●	●	Transit operators/ Airports		See "Airport Ground Access."
4. Improve vehicular traffic controls on the airport.	●			Airports		Controls to speed the flow of surface traffic on the airports can help reduce emissions.
5. Investigate aircraft towing and partial engine shutdown to reduce ground based emissions.		●	●	Airports		Improvements in aircraft engine emission rates should reduce severe aircraft-related air quality problems. Aircraft towing and partial engine shutdown should be investigated in the future if projected improvements do not materialize.
<u>ENERGY</u>						
1. Maintain high airline load factors.	●	●	●	Airlines		Sustained load factors above 60% are believed possible under airline deregulation.
2. Establish inter-airport transfer capability (air, water, or ground).		●		Transit operators	Suggest methods.	Airport transfer capability would mitigate against low load factors as new flights are added to OAK and SJC.
3. Reschedule operations during peak delay periods.	●	●	●	Airlines	Investigate scheduling impacts.	Voluntary rescheduling by airlines will reduce fuel consumption caused by delays at peak activity periods.

Table III-2 (Con't)

SUMMARY OF PROPOSALS

PROPOSALS	TIME FRAME			LEAD AGENCY	REGIONAL ROLE	COMMENTS
	S	M	L			
4. Reduce intra-bay operations.	●			Airlines		Fill-up operations between airports are not energy-efficient.
5. Increase use of mass transit and ride-sharing programs.	●	●	●	Transit operators Airports	Evaluate transit productivity.	Transit operators need to plan improvements so that increased service is not counterproductive by lowering vehicle occupancy.

IV. AVIATION FORECASTS

A. ISSUES AND PROBLEMS

No area of aviation planning has received such extensive debate as the air travel forecasts. Major changes in the direction of air travel growth have wide-ranging impacts on regional policies relating to the timing of airport improvements, compliance with the State's airport noise standards, and compliance with State and Federal air quality standards.

Starting in 1969, a series of forecasts were prepared for the Bay Area by the ABAG Regional Airport System Study (RASS), the Air Transport Association, the Federal Aviation Administration, and the California Department of Transportation. These forecasts often differed with respect to the air travel projections as well as the methodology used to arrive at these projections. More importantly, most of the forecasts failed to anticipate many significant changes that occurred in the aviation industry.

Regional forecasts prepared for the RASS in late 1969--at the peak of the 1960's growth curve--initially estimated that there would be 83 million annual passengers using the Bay Area airports by 1985. Subsequent data from the 1970 Federal census indicated a lower population growth rate for the region was appropriate, and the forecasts were adjusted to reflect a potential for 72 million annual passengers in 1985. By 1975 when ABAG and MTC reviewed the forecasts as part of MTC's Regional Transportation Plan, it was clear that the expansive growth that was predicted was not forthcoming. Thus the forecasts were again adjusted to show a range of 37-43 million annual passengers by 1985. Finally, in 1977 as part of the current study, a comprehensive review of the regional projections was undertaken. Federal regulatory actions and airline promotional programs occurring in 1977 caused further modifications in airline industry growth, requiring a second review in 1979; however, no changes were made at this time.

Modifications in the forecasts were essentially a response to a number of major events impacting the airline industry. These are briefly discussed below.

- 1969 - 1971. The economy was in a recession and traffic declined. At the same time, the airlines began to acquire the first of the wide-body aircraft and expenditures increased rapidly. Airline fare increases were slow to be approved and could not cover the rising labor costs and the costs of debt financing. Record losses in 1970 forced the industry to cut back service and lay off employees.
- 1972 - 1973. As a result of airline cost-cutting measures, new fare increases approved by the CAB, and rising traffic levels, these years were generally ones of recovery for the industry. Moderate profits were recorded for both years.

- 1974 - 1975. The OPEC oil embargo occurred in late 1973 and early 1974, again causing the airlines to cut back service and lay off employees. The embargo precipitated another recession in the economy and a decline in traffic in 1975. During the early months of 1975, fuel costs soared at almost \$2 million a day compared to 1974. Fare increases approved by the CAB to cover mounting fuel costs, together with a diversion of traffic from the automobile, enabled the airlines to show substantial profits in 1974; however, by 1975 the industry suffered its second largest loss in history. Capital formation for future airline re-equipment needs loomed as a problem.
- 1976 - 1978. A strong economic recovery began in 1976. As a result of airline cost control measures and a resurgence of traffic growth, airline profits were again restored. Airline traffic increased in each of the three years. During 1977 the airlines began to stimulate traffic growth with the introduction of promotional and discount fares. At the same time the Federal government started debating whether to "deregulate" the airline industry to restore greater competition. In 1977 the Air Cargo Deregulation Act was signed, followed by the Air Passenger Deregulation Act in 1978. Under the new act, Civil Aeronautics Board authority over routes will expire in 1981 and authority over fares will expire in 1982.
- 1979 - Present. Traffic increased in 1979 but the high costs of fuel and impending recession have cut sharply into airline traffic and profits.

Deregulation and fuel cost and availability have and will continue to be major influences on future forecasts:

- Air passenger forecasts--through changing air fares and constraints on jet fuel availability;
- Air cargo forecasts--through effects on level of service and capacity;
- Aircraft operations--through higher load factors and accelerated purchase of more fuel-efficient and quieter aircraft;
- Commuter airline activity--as replacement carriers for larger airlines that have withdrawn service from smaller communities.

Because of the tremendous uncertainty in both the short-range and the long-range forecasts, the variables underlying the forecasts will have to be continuously monitored and reviewed.

B. FINDINGS

Air Passenger Forecasts

- **Current Forecasts.** In 1977, RAPC reviewed a number of factors that were felt to influence air travel forecasts for the Bay Area. These included population, employment, and personal income trends, projections of real economic growth in the economy (GNP), and trends in airline fares. Statistical analysis of past data showed that a number of forecast equations fitted historical experience, but these equations also underestimated what was felt to be reasonable future growth rates.

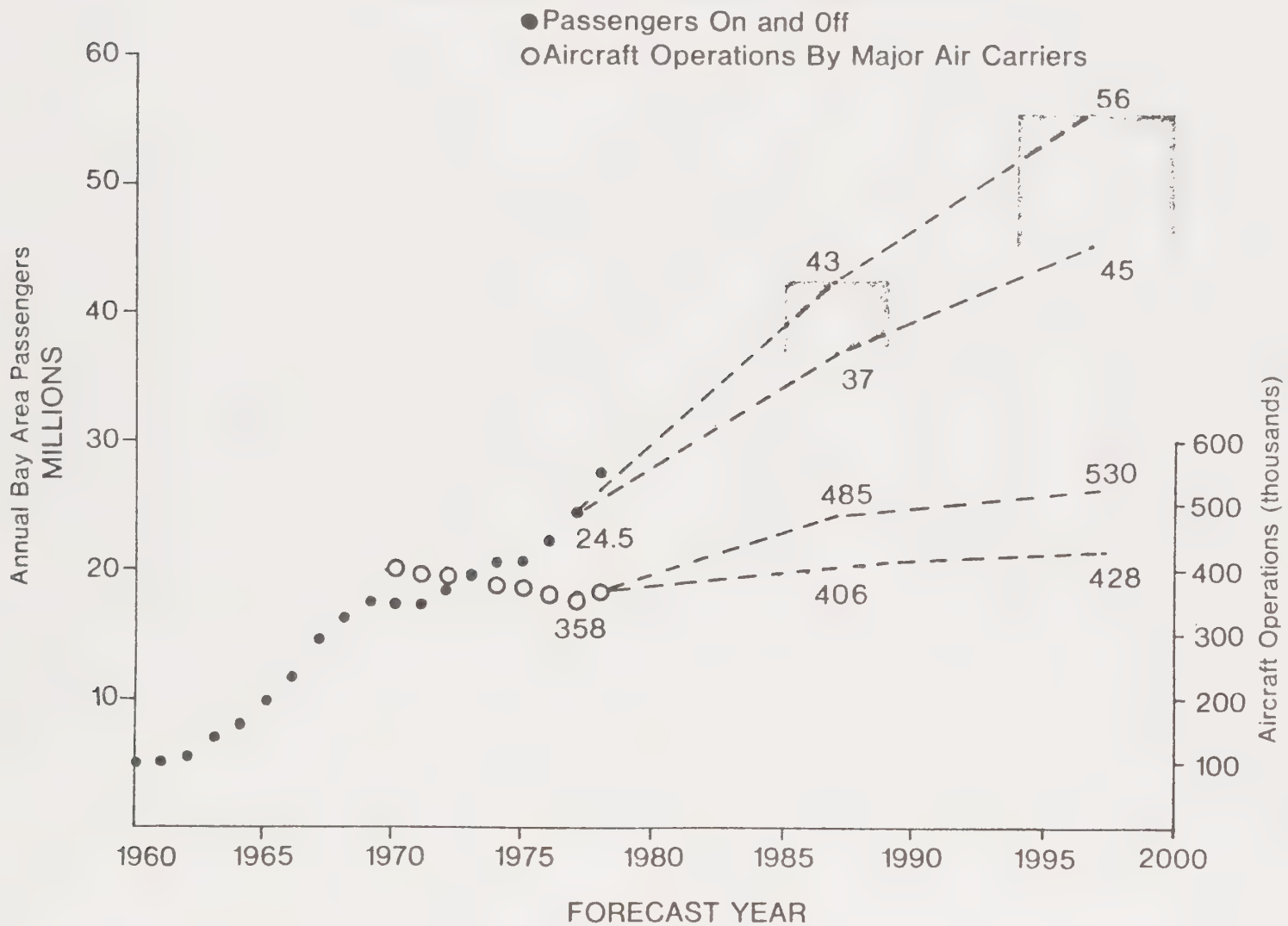
The final planning forecasts represent the consensus of members of the Regional Airport Planning Committee rather than the results of a specific forecast equation; uncertainty in the probable forecast values was dealt with by adopting a range in the forecasts that encompassed both the expected volume of passenger activity as well as the expected time at which the forecast would be reached (See Figure IV-1).

FORECASTS OF BAY AREA PASSENGERS

<u>Time Frame</u>	<u>Millions of Annual Passengers On and Off</u>
1985-1989	37-43
1994-2000	45-56

- **Recent Experience.** In 1976, 1977, and 1978, passenger volumes through the Bay Area airports increased 7.2%, 9.3%, and 13.3%, respectively. These rates differed noticeably from the period 1970-1975, in which the average annual growth rate was 3.6%. The causes behind the increased growth in air travel were twofold: First, in 1976 a recession in the U.S. economy was replaced by an expanding economy for the first time in a number of years. Secondly, passengers began flying more in response to the proliferation of low air fares which were awarded by the consumer-conscious CAB in 1977 and 1978. A substantial portion of traffic growth in 1978 was due to the implementation of new low fare programs by the airlines in 1977.
- **Projected Changes in Demographic Data.** Population, employment and income are traditional measures of the potential for a region to generate air travel. Population, as a variable in the forecast equation, measures the potential of the region's residents to produce air trips as well as attract non-resident passengers who are coming to the Bay Area to visit friends and relatives.

Figure IV — I
BAY AREA AIR TRAVEL FORECASTS



Employment can be used to measure business travel. Personal income is a surrogate variable for the economic vitality of the region (lacking a more direct measure such as a gross regional product).

DEMOGRAPHIC PROJECTIONS

	<u>1977</u>	<u>1987</u>	<u>1997</u>	<u>Units</u>
Population	4.93	5.46	5.99	Millions
Employment	2.12	2.53	2.80	Millions
Income	\$24,465	\$32,880	--	Billions

Note: 1987 and 1997 population and employment are interpolated from ABAG Series 3 projections.

Changes in the demographic base do not, however, sufficiently account for the impact of tourism and convention trade on Bay Area passenger volumes. Tourist and convention business is a major generator of air travel and one that will continue to significantly affect Bay Area traffic. Proposed plans for tourist and convention facilities in the Bay Area indicate that this segment of the Bay Area economy will continue to expand.

- **Economic Changes.** Changes in the economy have had a major impact on air travel demand in the past five to six years. Recession and inflation have been a continuing fact of life in the economy since 1970. Recessions occurred in 1970, 1974 and 1975. These have been followed by strong recoveries in 1972, 1973, and in 1976. Inflation has continued at a brisk pace; by 1978 the dollar was worth half of its value in 1967. In general, inflation depresses the market for pleasure travel and recession depresses the market for business travel. Inflation causes consumers to place assets in savings accounts or direct reduced purchases towards durable goods. Recession causes business to reduce expenditures of all kinds and consumers to increase savings because of employment uncertainties. Recent national economic forecasts indicate that real GNP (GNP measured in constant dollars) will increase 2.5 to 3.0% annually over the next ten years.
- **Air Fares.** Air fares were found to have the most significant impact on forecasts. "Real" air fares have continued to decline over the years. In other words, price increases in fares were less than price increases in other consumer goods. Thus the air trip has remained a "bargain" despite rising labor and fuel costs. (In 1977 and 1978, between 35-40% of the air passengers were traveling on some form of discount fare.)

The forecast analysis dealt with three fare scenarios - declining real fares, constant real fares, and increasing real fares - and produced a comparable range in forecasts. Within California, intrastate fares have increased significantly since deregulation. (Fares in the California Corridor have traditionally been the lowest in the nation for short haul trips.) Airline fuel costs continue to increase due to OPEC price hikes. For these reasons a constant or increasing real air fare seems the most likely condition for the next ten years.

- **Jet Fuel Availability.** The ability of the airlines to obtain adequate supplies of jet fuel to serve future demand is the newest factor that must be considered in the forecasts. The amount of fuel the airlines can obtain will directly affect the number of flights and the capacity of the airline system. It is virtually impossible at this time to determine how much fuel the airlines will have in the future. It is even more difficult to correlate fuel supplies with passengers using the Bay Area airports. This is because an actual fuel shortage would involve changes in the aircraft fleet mix, route system, and scheduling that cannot be predicted at this time. Estimates of the Bay Area aircraft fleet mix and fuel efficiency characteristics of the future airline fleet, however, indicate that the aircraft fleet as a whole will be up to 45% more fuel efficient in 1987 and up to 55% more fuel efficient in 1997 (measured in passenger miles per gallon). Theoretically this means that if the airlines flew the same number of miles in 1987 as they did in 1977 and had the same amount of fuel, they could transport 45% more passengers; however, as mentioned above, this is only a very rough estimate based on current load factor trends, projected airline fleet changes, etc. The following table compares order-of-magnitude estimates for increases in fuel consumption corresponding to increases in passenger activity levels.

PROJECTED INCREASES IN AIRLINE FUEL CONSUMPTION

<u>Year</u>	<u>Forecast Range</u>	<u>Passenger Increase Compared to 1977</u>	<u>Fuel Consumption Increase Compared to 1977</u>
1987	Low	51%	28% - 34%
	High	76%	45% - 53%
1997	Low	84%	40% - 47%
	High	129%	67% - 78%

- **Auto Fuel Availability.** One interesting phenomenon that occurred during the 1973-1974 oil embargo was a diversion of trips from the automobile to air transportation. This took place because of the uncertainty by motorists over the availability of fuel. Rather than risk being stranded on the highway, many passengers opted for the greater security of a reservation on a scheduled flight. A future scarcity of automobile fuel could have a similar effect.
- **Combined Effects.** One way to check the reasonableness of the RAPC forecasts is to test the assumptions that are required to "make the forecasts happen." Assuming that historical forecast relationships continue, real GNP and personal income would have to grow 3.8% annually and real air fares would have to decrease 7% annually to reach the 43 million annual passenger level in 1987. These growth rates compare to a 3.2% annual growth rate in GNP and personal income between 1970 and 1978 and a 3.0% annual decrease in real air fares. In order to reach 37 million annual passengers in 1987, real GNP and personal income would need to increase 3.2% annually and real air fares would have to decrease at the historic rate over the past 8 years. Thus, the high RAPC forecasts are contingent on a fairly healthy economy and continuation of the type of low fare programs inaugurated by the airlines in 1977.

Air Freight and Air Mail

- **Current Forecasts.** Regional forecasts represent a 6-8% annual growth rate in air freight tonnages. Air freight forecasts were developed by reviewing forecasts from various sources and using a consensus among these forecasts. Civilian mail volumes were projected based on population and employment growth in the region. Military mail volumes were assumed to continue at peacetime levels.

FORECASTS OF BAY AREA AIR CARGO

(Annual Tons On and Off)

	1977	1987		1997	
		Low	High	Low	High
Freight	390,000	673,000	721,000	1,150,000	1,650,000
Mail	<u>100,000</u>	<u>117,000</u>	<u>117,000</u>	<u>135,000</u>	<u>135,000</u>
Total	490,000	790,000	838,000	1,285,000	1,785,000

- **Past Experience.** Shipment of air freight dropped off significantly between 1970 and 1976, as shown in the following statistics:

<u>Period</u>	<u>Average Annual Cargo Growth in the Bay Area</u>
1960 - 1965	24.1%
1965 - 1970	13.1%
1970 - 1976	1.4%

During this period all-cargo aircraft service was not a profitable industry. The airlines reacted to economic pressures by reducing the number of cities receiving all-cargo service from 50 in 1967 to 12 in 1977. One of the major constraints on future cargo growth appears to be the number of all-cargo aircraft. More and more cargo is being flown in daytime commercial passenger aircraft at premium rates.

- **Recent Experience.** In 1976, 1977, and 1978 air cargo handled at the Bay Area airports increased 5.3%, 8.8%, and 12.7%, respectively. The Air Cargo Deregulation Act of 1977 went into effect in November, 1977, removing most rate and entry restrictions on domestic air freight carriers. Several air carriers moved aggressively into new markets. Flying Tiger expanded its route system into southeastern portions of the U.S., as well as into Alaska and the Pacific. Federal Express, specializing in small packages, also expanded its operations and lift capacity by acquiring a fleet of B-727 cargo aircraft.

International air cargo is expected to flourish, particularly in the industrially developing central and north Pacific. The Bay Area will probably participate heavily in air cargo development in the Pacific because of its proximity to these markets. Overall, however, reactions to cargo deregulation are mixed. Service tends to remain concentrated in selected major hub cities where the air passengers travel, rates have increased 10-25%, emphasis remains on the small package shipper, carrier damage liability has decreased, and all-cargo lift capacity has remained static. In addition, one major trunk airline ceased all-cargo operations in 1978.

- **Combined Effects.** While there are a few "expansive" forecasts in the 10-12% range, the 6-8% annual growth rate appears to be a valid planning range, given the uncertainties and problem areas noted above.

Airline Operations

- **Current Forecasts.** There has been a significant downward trend in number of airline operations in the Bay Area coupled with an upward trend in the number of passengers per operation. The downward trend in operations resulted from a slowdown in traffic growth in the early 1970's, a replacement of older equipment by higher capacity aircraft, and the Arab oil embargo in 1973-1974 which forced major schedule reductions. Current forecasts are shown below. (Also see Figure IV-1.)

FORECAST OF AIRCRAFT OPERATIONS BY MAJOR AIRLINES

(Total Bay Area Operations)

Year	Annual Operations*		Boarding Load Factor	Seats Per Departure		Passengers Per Operation**	
	Low	High		Low	High	Low	High
1977	358,000		53.3%	138		73.5	
1987	398,000	477,000	56.4%	160	169	90	95
1997	421,000	522,000	57.7%	185	193	107	111

*Includes non-revenue, aircraft positioning, and charter flights

**Passengers per scheduled, revenue operation

- **Recent Experience - Passenger Service.** Recent experience indicates that the number of passengers per operation is increasing faster than assumed in the regional forecasts above. This increase can be attributed to the lower air fares--and commensurate increase in breakeven load factors for the airlines--and shortage of airline capacity. In 1978 the major domestic trunk airlines operated at revenue load factors approaching 62% while the international carriers achieved revenue load factors slightly in excess of 65%. As load factors level off at these higher values, the controlling factor governing growth in passengers per operation will be the rate at which airlines can add capacity to their aircraft fleets. Assuming that the rate of growth in seating capacity remains the same but that the Bay Area load factors are five percentage points higher in 1987 and 1997 than initially forecasted, the passengers per operation forecast would be 98-104 in 1987 and 116-121 in 1997. If this load factor trend were to take place, airline operations forecasts for the Bay Area would be reduced 8% in 1987 and 1997. Such a load factor trend would be reinforced in an extremely fuel-scarce industry. Also in a fuel-scarce industry traditional assumptions about maximum sustainable load factors would need to be reviewed in greater detail.

- **Aircraft Fleet.** Projected changes in the aircraft fleet mix are shown in the table below. The types of aircraft operating at each airport will have a major impact on future airport noise levels and on airport capacity. These estimates show a gradual phasing out of the older three- and four-engine jets, increased use of wide-body aircraft, and the introduction of new technology aircraft in the early to mid-1980's. The new aircraft types, classified by their approximate passenger loads, are the B-757 and B-767 (New 200), the DC-9-80 (New 150), and a new 125 passenger aircraft resembling the DC-9-50. All of the new technology aircraft will be significantly quieter and more fuel efficient than the aircraft they will replace.

PROJECTED CHANGES IN AIRCRAFT FLEET MIX

(Percent of Total Operations)

<u>Aircraft Type</u>	<u>Common Aircraft</u>	<u>1975</u>	<u>1987</u>	<u>1997</u>
4 Engine Wide-Body	B-747	4.0%	5.7- 7.1%	8.0- 9.1%
4 Engine Regular-Body	DC-8, B-707	22.1%	9.7-10.5%	--
3 Engine Wide-Body	DC-10, L-1011	6.8%	10.7-11.3%	14.9-15.2%
3 Engine Regular-Body	B-727	37.9%	45.5-46.6%	26.2-26.9%
2 Engine Regular-Body	DC-9, B-737	28.1%	18.8-19.3%	9.6-10.3%
New 200 Passenger	B-767		3.9- 4.6%	15.1-16.6%
New 150 Passenger	DC-9-80		1.8- 2.0%	10.0-10.4%
New 125 Passenger	DC-9-50		1.2- 1.3%	13.0-14.7%
Turbo Prop	Electra	1.1%		

- **Commuter Airline Service.** Commuter airline activity has already increased dramatically as a direct result of the Airline Deregulation Act. Commuter airlines (also called Third Level Air Carriers) have stepped in to provide air service to cities that have experienced a deterioration or loss of service due to the departure of a larger air carrier seeking more profitable routes. Major California cities that have been affected include Fresno, Stockton, Bakersfield, and Modesto. Section 419 of the Airline Deregulation Act of 1978 guarantees that "essential" airline service shall be maintained in small communities that are currently receiving or at one time received service by a CAB-certified airline over the past ten years. The CAB must determine what the

essential service levels are and provide subsidies to assure that these levels are maintained. The CAB must also assist the communities in finding replacement service when a certificated carrier withdraws.

It is therefore possible that one or two daily flights by a large jet may be replaced by 5-10 daily flights by smaller aircraft, thus greatly increasing the total number of operations. The aircraft operations forecast below reflects the uncertainty concerning the ultimate role of this sector of the airline industry.

FORECAST OF COMMUTER AIRLINE OPERATIONS

(Annual Operations)

1977	1987		1997	
	Low	High	Low	High
62,000	43,000	84,000	68,000	111,000

- **All-Cargo Service.** Recent acquisitions by U.S. and foreign cargo carriers show that the expected trend towards use of the wide body aircraft for all-cargo operations is taking place. At the same time, however, small package air carriers and new cargo carriers are beginning to expand as a result of the Cargo Deregulation Act and are acquiring older equipment. Thus it is possible that the 8,000 annual air cargo operations initially forecasted for 1987 and 1997 may represent the lower threshold of the forecast range with the higher threshold being closer to 10,000 annual all-cargo operations.

FORECAST OF ALL-CARGO AIRCRAFT OPERATIONS

(Annual Operations)

1978	1987		1997	
	Low	High	Low	High
12,000	8,000	10,000	8,000	10,000

C. PROPOSALS

Air Passenger Forecasts

Because of the quickness with which economic, fuel, and other factors affect the airline industry, regional forecasts should be reviewed every two years and adjusted accordingly. A policy of progressive incremental adjustments in the order of 0%, +5%, or +10% should be considered based upon a review of current information and trends. These adjustments will provide updated information necessary to continue various airport planning programs. Revisions to MTC's Regional Transportation Plan and ABAG's Regional Plan will be required to reflect the new forecasts.

Airport Activity Reports

The Bay Area airports publish monthly activity reports that tabulate passenger, cargo, and mail volumes and airline operations performed. The method for assembling and reporting this data varies by airport. Regional forecasts require an accurate record of historical data that is comparable for all airports. Therefore, it is suggested that the airport operators collectively review their reporting methods and present the data in a consistent manner.

V. AIRPORT SYSTEM ALTERNATIVES

A. ISSUES AND PROBLEMS

The need for a regional overview of airport planning has long been apparent. The use of Bay Area airspace is already "managed" by a quasi-regional agency, in this case the Federal Aviation Administration's Terminal Radar Approach Control Facility, since aircraft operations at one airport interact with operations at other Bay Area airports. Several other factors are also relevant:

- Airports in the Bay Area serve a broad regional demand for passenger and cargo service extending well beyond the immediate jurisdiction of the airport operators.
- Noise from aircraft landings and takeoffs and from aircraft "overflights" affects a large number of Bay Area communities. Certain communities have borne the major effects of the growing regional demand for air transportation simply because they are located near the airports.
- Emissions from aircraft and automobiles affect regional as well as local air quality.
- Ground transportation improvements often involve coordination among more than one political jurisdiction. The programming of funds for highway and transit improvements takes place at the regional level.
- Conservation of energy has emerged as a major goal in transportation planning. How new airline service is developed in the region will have a significant impact on the consumption of transportation energy both on the ground and in the air.
- Airport expansion has historically resulted in some filling of the Bay. Protection and enhancement of the Bay as one of the region's most significant environmental resources is an important concern.

As a result of State legislation in 1971, the Metropolitan Transportation Commission was created and was given the responsibility for preparing a Regional Transportation Plan (RTP). Subsequent legislation expanded the concept of the Regional Transportation Plan to include a plan for aviation facilities and services. In response to this legislation, MTC prepared an Airport Element for the RTP in 1975. This element contained substantially reduced air passenger forecasts for the region. Expansion of all airports was recommended; however, the reduced forecasts avoided the need for a second runway in the Bay at Oakland Airport. The number of passengers to be accommodated at a North Bay site was set at 1 million annual passengers at Hamilton AFB, Napa County Airport, Sonoma County Airport or Travis AFB.

Further adjustments were made in the Plan in 1976 to make airport service recommendations for the North Bay contingent on local participation in a cooperative study of North Bay aviation needs. In 1977 the RTP was revised to acknowledge the change in forecasts that were prepared for this study.

The Regional Airport System

Regional aviation demand is served by San Francisco, Oakland, and San Jose Airports. (See Figure V-1)

CURRENT AIRPORT ACTIVITY LEVELS

<u>Airport</u>	<u>1979 Passengers*</u>	<u>1979 Cargo** (Thousands of Tons)</u>
San Francisco International	22,600,000	485,000
Oakland International	2,700,000	12,100
San Jose Municipal	<u>3,600,000</u>	<u>10,900</u>
Regional Total	28,900,000	508,000

*Excludes estimated "through" passengers

**Includes air freight and air mail

The San Francisco Bay Area is the fifth most active airport "hub" in the United States behind Chicago, New York, Atlanta, and Los Angeles. San Francisco Airport, the region's major airport, handles 78% of the passenger traffic and almost all of the air cargo. International service as well as a significant portion of domestic service is located at San Francisco Airport. Private investment in passenger service facilities, aircraft service facilities and air cargo facilities is substantial.

Oakland Airport's share of Bay Area passenger traffic averages between 9% and 10%. Oakland's activity rose sharply in the late 1960's when intrastate carriers inaugurated new service in California markets. Between 1965 and 1969 there was also rapid growth in service to Europe and Hawaii by supplemental air carriers headquartered at Oakland. This service subsequently declined in the early 1970's as scheduled carriers introduced competing low group fares. Development of new interstate service has fluctuated with the economy and airline profitability.

San Jose Airport's share of Bay Area passenger traffic is about 12% and has been gradually increasing on the strength of economic and population growth in the South Bay and new airline service. Like Oakland, San Jose's development received a major impetus in the late 1960's with the inauguration of new intrastate service. The airport has been somewhat

FigureV-1

BAY AREA AIRPORTS



more successful than Oakland Airport in attracting and retaining new interstate service.

Past Airport System Alternatives

The formulation of airport alternatives for this study is the result of an evolutionary process that began in 1969 with the Regional Airport System Study (RASS).

In 1970, the RASS Committee proposed eleven alternative combinations of airport sites and capacities to accommodate forecasted demand. The eleven alternatives included new air carrier airports at San Jose (Site E), Hamilton AFB, Concord, Livermore, Travis AFB, Sonoma County, Richmond, Napa County, and Hollister. To the original list was added a mid-Bay airport, a new airport in eastern Contra Costa County, and a new airport in Marin County. As a result of the public response to these alternatives, the RASS Committee removed the following airports from active consideration for air carrier use:

- Hollister
- Site E
- North Bay
- Mid-Bay
- Richmond
- Concord
- Livermore
- Lakeview Road (Sonoma County)

The recommended plan placed a policy limit on San Francisco Airport of 31 million annual passengers for capacity and environmental reasons. Oakland Airport was recommended as the airport to serve a major share of new demand in the region. Oakland Airport was assumed to have a second parallel runway which would be constructed in the Bay and would nearly double the airport runway capacity. A second parallel runway, to be constructed in the Bay, would nearly double the airport runway capacity. Oakland's advantages were its accessibility and over-water takeoffs and landings, which minimize noise perceived by nearby residents; its disadvantages, the Bay fill required for the second runway.

San Jose, in the midst of high South Bay population expectations, put a lid on its airport at around 10 million annual passengers for environmental reasons. Much of the demand generated in that area then would have to go to San Francisco and Oakland.

Travis AFB presented the problems of a remote site. Most people would not choose to travel to Travis AFB unless unique service were placed there. Capital costs for access and terminal facilities for a major airport at this site would be large.

Napa or Hamilton was slotted to meet the local need of the northern counties for California Corridor service rather than to serve as a major regional airport. Capacity in this role would be for about one million passengers annually at either one or the other, but not both. Local sponsorship or veto would be the controlling factor in the selection. (See Figure V-1)

Thus the recommendations became:

RECOMMENDATIONS FROM REGIONAL AIRPORT SYSTEM STUDY (RASS)

(Millions of Annual Passengers)

<u>Airport</u>	<u>1975</u>	<u>1980</u>	<u>1985</u>
San Francisco	19	23	31
Oakland	6	13	24
San Jose	3	6	10
Travis	0	1	6
Napa or Hamilton	<u>0</u>	<u>1</u>	<u>1</u>
TOTAL	28	44	72

Current Issues

Current demand projections and past policy decisions limit the scope of the airport system alternatives that were reviewed. Two major assumptions have been made with respect to the development of the regional airport alternatives:

- 1) Maximum use shall be made of existing airports in accommodating projected levels of demand.
- 2) Development of a new regional airport in the Bay Area is not feasible because of the magnitude of the costs and the difficult environmental issues that would have to be faced.

Several other developments have a bearing on the airport system alternatives. First, after several years of study, the City of San Jose dropped from further consideration the possibility of developing an entirely new airport to replace the existing air carrier facility. Second, MTC and Solano County completed a study to determine the feasibility of joint civilian-military use of Travis AFB. Third, Hamilton AFB was declared surplus by the Federal government in 1976 and is being disposed of by the General Services Administration for possible aviation use.

The airport system alternatives defined for this study are relatively subtle compared to earlier alternatives. They primarily focus on traffic adjustments within the existing system of airports. However, the impact of the traffic allocations on a single airport, such as Oakland or San Jose, will be substantial because of the relatively low level of current activity. In addition the concept of a North Bay airline service point for limited intrastate service involves local and regional policy issues that are as sensitive as any of the issues explored in the original study.

This discussion highlights the issues that need to be addressed. The issues, ranked in priority order are:

- Air Passenger Redistribution to Oakland and San Jose Airports. The regional plan proposes that Oakland and San Jose handle a larger share of future Bay Area air travel demand. The assumptions underlying this policy need to be tested to assure their continued validity. It is also necessary to reevaluate the 10 million annual passenger policy limit at San Jose Airport to determine whether this limit should be retained, or possibly lowered, due to adverse noise impacts. The need to study a second runway in the Bay at Oakland Airport is not a consideration in the current study due to the lower demand forecasts.
- Traffic to a North Bay Airport. The regional plan assigns up to two million annual passengers to a North Bay airport in 1997. Strenuous objections have been aired with respect to this policy by Napa County and Marin County. The policy is intended to indicate: (a) a demand for California Corridor service that could be provided at one of the four existing airports in the North Bay (Hamilton AFB, Napa County, Sonoma County, or Travis AFB), and (b) a long-range regional need to relieve noise and surface traffic impacts at San Francisco and Oakland Airports by having the North Bay serve a portion of the demand generated in that area.
- Air Cargo Redistribution. Unlike passengers, cargo is not inconvenienced by having to use a more distant airport. However, the concentration of cargo flights at San Francisco, particularly the number of flights in the late evening, is of growing concern to noise-impacted residents in communities around the airport. The potential exists to use Oakland Airport to serve some portion of the all-cargo traffic.
- California Corridor Rail Alternatives. The short haul air travel market in the California Corridor constitutes about 40% of the Bay Area air travel demand. The diversion of some passengers to a competitive rail transportation system could affect the need for expanded airport facilities in the Bay Area. Various levels of improved rail service were tested.

B. APPROACH

Increased demand for air service will have wide-ranging impacts on airport capacity, the environment, and the commitment of financial resources. Different options for expansion of airports and airline service need to be carefully reviewed to determine which of these options represents the best choice for the region. The purpose of the regional airport system plan is to develop appropriate guidelines within which this expansion can take place. To do so requires extensive analysis of the available options to demonstrate the wisdom of regional policy. Proposed policies can then be coordinated with the airports, regulatory agencies, and airlines as part of an overall implementation plan.

The principal factors considered in the regional plan include:

- The convenience of the system for the users
- The adequacy of runway, airspace, and ground access capacity and opportunities to manage demand to fit available capacity
- Airport noise impacts and methods for controlling noise
- Local and regional air quality impacts and methods for attaining State and Federal air quality standards
- The impact of increased demand on energy consumption by aircraft and airport surface transportation modes
- The potential need for filling of the Bay to expand airport facilities
- The costs of airport expansion
- The impact of air passenger and air cargo growth on employment in the region and on the demand for land on and adjacent to the airports

The choices that are available are termed "airport system alternatives." Essentially each alternative represents a different method of providing for regional demand involving alternative assignments of traffic to each airport. Each alternative can be compared with respect to the factors above to provide decision makers with information to develop local and regional policy.

The assessment of each airport's air passenger potential is directly related to a combination of three factors:

- the forecasted number of passengers within each airport's geographic service area
- the destinations served from each airport
- the frequency of airline service to these destinations

Airport Service Areas

The airport service area is the geographic area that is most accessible to a particular airport due to the characteristics of the regional ground transportation system.

Data from the 1975 MTC Air Passenger Survey shows that over 60% of the passengers using San Francisco Airport presently come from San Francisco and San Mateo Counties. About 90% of the passengers using Oakland Airport come from Alameda and Contra Costa Counties. Eighty percent of the passengers using San Jose Airport are generated in Santa Clara County and a significant number--about 8%--come from Santa Cruz County and northern Monterey County. Currently Oakland Airport serves only 47% of the air passengers in Alameda and Contra Costa Counties and San Jose Airport serves 58% of the passengers in Santa Clara County. (See Figure V-2)

1975 ORIGINS OF PASSENGERS TO INDIVIDUAL AIRPORTS

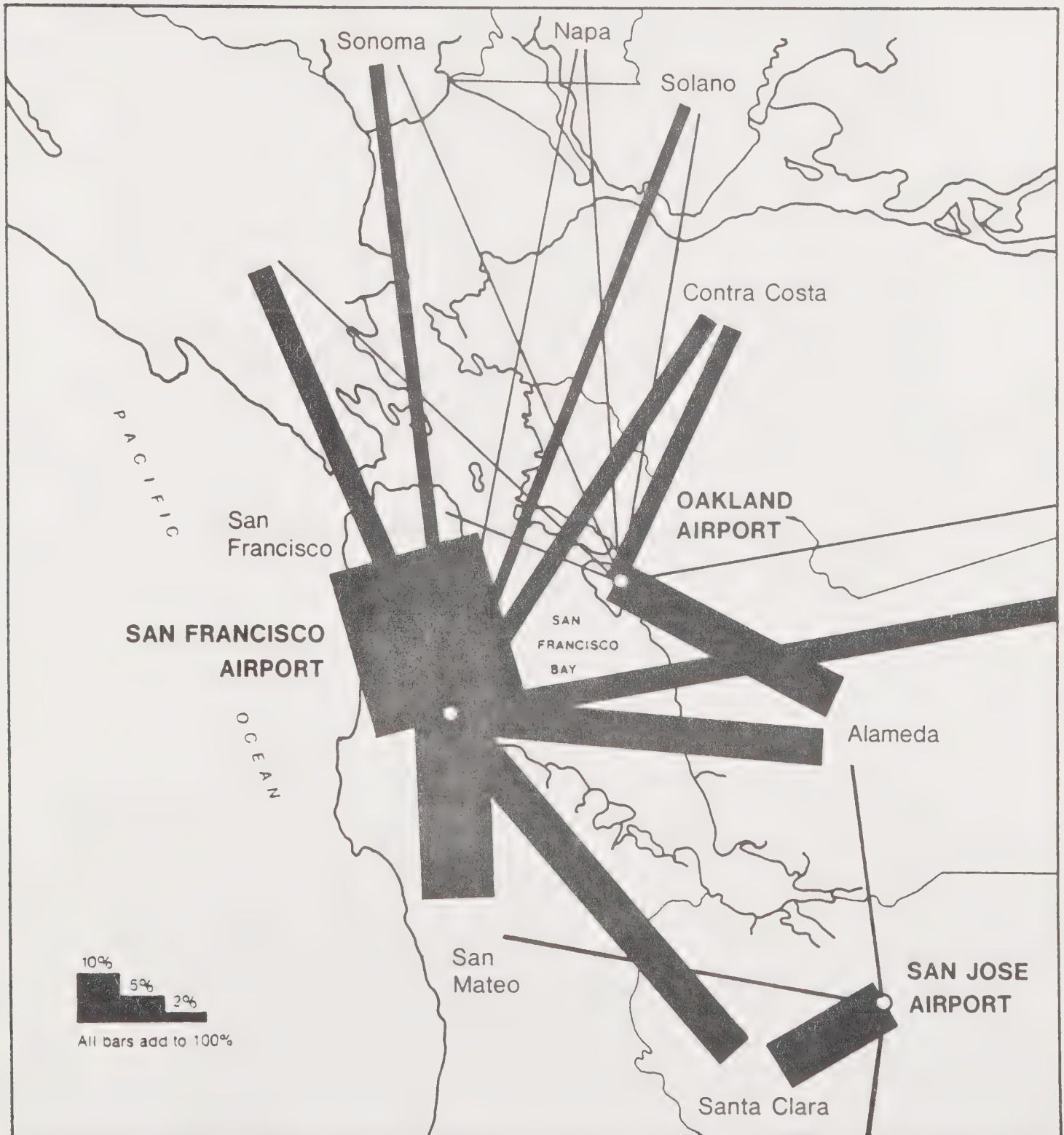
<u>County Origin of Air Passenger Trip</u>	<u>Airport (%)</u>			<u>TOTAL</u>
	<u>San Francisco</u>	<u>Oakland</u>	<u>San Jose</u>	
Alameda	9.3%	65.7%	5.3%	15.4%
Contra Costa	4.9	22.5	0.3	6.4
Marin	5.4	1.6	-	4.3
Napa	0.5	0.9	-	0.5
San Francisco	41.8	2.6	0.6	32.0
San Mateo	19.7	0.5	4.3	15.5
Santa Clara	9.5	0.7	81.3	17.5
Solano	2.1	1.7	-	1.8
Sonoma	4.7	0.8	7.9	4.6
Out-of-Region				
	100%	100%	100%	100%
TOTAL				

Source: 1975 MTC Air Passenger Survey

The airport service areas were defined by two means: (a) by reviewing the origins and destinations of all passengers using each airport, and (b) by reviewing the origins and destinations of passengers in the California Corridor. (The California Corridor air market to Los Angeles, Orange County, and San Diego is served by frequent flights from all three Bay Area airports. The choice of airports in this market will therefore be largely governed by surface accessibility.) In addition future improvements in the regional transportation system need to be reviewed to determine their effects on airport accessibility.

Figure V-2

ORIGIN OF PASSENGERS TO INDIVIDUAL AIRPORTS



For the purpose of analyzing airport traffic potential, the service area for each airport was generally defined to include the following counties:

San Francisco Airport - San Francisco, San Mateo, Marin, and most of Sonoma Counties

Oakland Airport - Alameda, Contra Costa, Napa, Solano, and portions of Sonoma County

San Jose Airport - Santa Clara and portions of Southern Alameda and Southern San Mateo Counties

North Bay Airport (when included in the airport alternatives)
- Marin, Napa, Solano, and Sonoma Counties.

Estimates of the future traffic in each airport service area were developed by combining separate forecasts of resident and non-resident air passenger locations. These projections were based on the Series 3 projections for population, employment, and income prepared by the Association of Bay Area Governments. The distribution of hotel rooms in the region (a measure of tourist attraction) and distance from the airport were also found to be significant factors affecting the location of passenger demand in the region. The county projections are shown below. Passenger demand within each county was further partitioned into 440 zones, a regionwide zone system used by ABAG and MTC for transportation and land use planning.

FORECASTED PERCENTAGE OF AIR PASSENGERS BY COUNTY

(Includes Both Residents and Visitors)

<u>County</u>	<u>1975*</u>	<u>1987</u>	<u>1997</u>
Alameda	16.2%	16.3%	15.8%
Contra Costa	6.7	7.2	7.4
Marin	4.5	4.3	4.5
Napa	0.5	0.6	0.7
San Francisco	33.5	31.3	29.8
San Mateo	16.3	15.6	15.0
Santa Clara	18.4	20.2	21.2
Solano	1.9	2.3	3.1
Sonoma	<u>2.0</u>	<u>2.2</u>	<u>2.7</u>
Total	100.0%	100.0%	100.0%

*Source: 1975 MTC Air Passenger Survey

The resulting passenger potential in each service area is shown below:

SERVICE AREA POTENTIAL

(Millions of Annual Passengers)

<u>Airport</u>	<u>1987</u>		<u>1997</u>	
	<u>Low</u>	<u>High</u>	<u>Low</u>	<u>High</u>
San Francisco	15.9	18.5	19.0	23.7
Oakland	7.7	8.9	9.9	13.4
San Jose	6.7	7.8	8.9	10.8
North Bay	--	1.1	--	1.8

Note: 1) Forecasts do not include connecting or out-of-region passengers.

2) North Bay forecasts include only passengers in Southern California market.

While the service area projections provide an indication of the maximum traffic potential for Oakland, San Jose, and a North Bay Airport, it is clear that service to all possible destinations from these airports would not be economically feasible. Thus, a portion of the passengers in these service areas will always use San Francisco Airport because of the unique services provided at this airport.

For some alternatives discussed later on, Oakland Airport's service area was expanded to include downtown San Francisco in order to meet overall service objectives established in the regional plan. This assumption is consistent with existing and planned transportation services between Oakland and the downtown area. A small portion of passengers using the Bay Area airports will come from outside the nine-county MTC planning region. This portion is expected to be about 4.5% of all passengers originating or terminating their trip at a Bay Area airport and is assumed constant throughout the forecast period. Connecting passengers--those passengers using Bay Area airports to transfer between flights--are forecasted to decrease from 15% of Bay Area passengers in 1975 to 13.0% in 1987 and 12.5% in 1997.

Airport Accessibility Considerations

- Transit. The proposed BART Extension to San Francisco Airport and the proposed automated Connector System linking BART to Oakland Airport present interesting accessibility issues. A direct BART extension to San Francisco Airport would increase transit

accessibility to San Francisco Airport for East Bay passengers but may not significantly improve upon existing express bus service for passengers in downtown San Francisco. Direct BART service from the growing Concord-Walnut Creek area as well as the central Oakland-Berkeley area would provide major competition with any transit improvements to Oakland Airport and could weaken the Oakland market potential.

The proposed connection to BART at Oakland Airport would generally improve transit accessibility from all parts of the East Bay and San Francisco. Some areas would receive better service than others. Air passengers on the BART Richmond-Fremont line would be required to transfer once at Coliseum Station while those on the Daly City-Concord line would have to transfer twice. The connection could, however, greatly improve the image of Oakland Airport and could prove attractive for passengers with destinations in downtown San Francisco.

With respect to upgraded Southern Pacific peninsula rail service, improvements in this service would increase the accessibility of San Francisco Airport from Santa Clara County.

- Highway. Although funding constraints will limit major new highway construction, completion of portions of the approved system and upgrading of other portions will have some effect on airport accessibility. Construction of the Hoffman Freeway between the Richmond-San Rafael Bridge and I-80 in Richmond will improve access from Marin County to the East Bay. As congestion increases in the Golden Gate Corridor and through downtown San Francisco, Marin passengers may choose the quicker, less congested route to Oakland Airport. Completion of the Grove-Shafter Freeway will improve access from Contra Costa County to Oakland Airport via Route 17. Some Contra Costa passengers currently find it easier to continue across the Bay Bridge to San Francisco Airport because of the awkwardness of the existing connection to Route 17 via local streets. Widening Route 17 from the Santa Clara County line to the junction with Route 101 near San Jose Airport will generally improve access from southern Alameda and reinforce the historical reliance of this area on airline services at San Jose Airport.

Airline Service Assumptions

The other major factors considered in estimating airport traffic potential include the destinations served and the frequency of service. Airline service levels are important because airports as well as airlines compete with each other for passengers. The 1975 MTC Air Passenger Survey was used to establish relationships between the frequency of service at each airport and the share of the market attracted. It was found that both Oakland and San Jose Airports must provide fairly high frequencies in order to attract a large share of local demand.

This occurs because many passengers will continue to choose the convenience of more numerous San Francisco departure and arrival times (and connecting possibilities at "downline" airports) over the comparatively less flexible schedules at the smaller airports. In order to analyze these variables, a model was developed by MTC that relates traffic potential to airline service characteristics by considering:

- a) future traffic demand in 38 major air travel destinations
- b) frequency of service and minimum plane load requirements in each market (minimum plane load requirements assure that only services that are economically feasible are provided).
- c) airline scheduling practices that "flow" downline traffic through intermediate connecting airports such as Chicago, Denver, Dallas-Ft. Worth, and Atlanta. (This results in pooling of traffic and increases the effective market size of some destinations.)

The analysis implicitly assumes that flights will be provided when the service becomes economically feasible rather than uniquely locating certain flights at Oakland and San Jose Airports in order to attract passengers to these airports.

Air Cargo Alternatives

Several factors indicate that air cargo will continue to be concentrated at San Francisco Airport. First, most of the air freight forwarders are located near San Francisco Airport. While these companies pick up and deliver air cargo from all over the region, their proximity to San Francisco dictates use of this airport. Secondly, several major air cargo carriers have decided to expand facilities at San Francisco Airport and one cargo carrier has opened a new facility off the airport. Finally, the extensive schedules at San Francisco provide considerable flexibility to the shipper in deciding where and when to ship cargo, a convenience demanded by the volatile nature of today's competition.

Airport cargo forecasts, therefore, assume that: (a) 50% of the cargo will be shipped in all-cargo aircraft using facilities at San Francisco Airport, and (b) the remaining 50% of the cargo volume will be shipped in the cargo compartments of passenger aircraft and the distribution of this cargo among the Bay Area airports will be a function of the passenger schedules at each airport.

Rail Alternatives

Because of historical interest in the subject of high-speed rail transportation in the California Corridor and its impact on airport planning in the Bay Area, a separate study of this subject was commissioned. The objective of the study was to quantify the magnitude of potential diversions of air passengers to various forms of intercity

rail service. The "corridor" included six cities outside the Bay Area: Sacramento, Fresno, Bakersfield, Los Angeles, Santa Ana, and San Diego. Each of those cities has both existing air and rail service, although rail service is limited to one train each way per day. Santa Ana is contiguous with the Los Angeles metropolitan area, and it was difficult to isolate as a separate city in the analysis since many air travelers bound for Santa Ana utilize other airports in the Los Angeles area. The Bay Area cities included San Francisco, Oakland, and San Jose, each of which has major airline service to other cities in the Corridor; only Oakland and San Jose have railroad passenger service.

In addition to looking at the existing rail system, the study developed mode choice estimates for three improved rail service levels. These systems consisted of an Improved Conventional Rail System which includes a direct rail link from Bakersfield to Los Angeles, a new Improved Passenger Train with 110 mph average speeds, and a High Speed Ground Transport vehicle with top speeds of 300 mph on exclusive guideways.

Because currently available information on characteristics of intercity air and rail passengers in the Corridor is very limited, the study concentrated on reviewing intercity mode choice relationships that had been developed in other urban corridors and that might be applicable to travel between the Bay Area and other California cities.

Estimated rail diversion ranges from 1.2% to 2.5% of regional air travel demand in 1997 if all six cities are served. This analysis suggests that such systems would not have a large impact on the Bay Area airport system through 1997. The study also recommended that any future analysis of the potential diversion of intercity air travel should include both bus and rail as competing modes.

ESTIMATED DIVERSION OF AIR PASSENGERS TO COMPETING RAIL MODES

- 1997 High Passenger Forecast -
(Annual Passengers)

	<u>Conventional Rail</u>	<u>Improved Passenger Train</u>	<u>High Speed Ground Transportation</u>
Los Angeles	414,700	614,900	915,200
San Diego	71,500	108,500	160,300
Sacramento	69,300	72,800	79,800
Santa Ana	98,700	146,800	211,700
Fresno	18,700	21,800	28,300
Bakersfield	<u>14,200</u>	<u>16,400</u>	<u>19,900</u>
TOTAL	687,100	981,200	1,415,200
Percent of Regional Air Travel Demand in 1997	1.2%	1.8%	2.5%

C. DESCRIPTION OF ALTERNATIVES

The major differences between the airport system alternatives defined for the study are discussed below (See Figures V-3 and V-4 for projected airport passenger volumes):

Alternative 1. Existing Airport Shares

Alternative 1 provides the "basecase" with which to compare proposed reallocations of traffic among Bay Area airports. In this alternative it is assumed that each airport maintains its current share of traffic to the major air travel destinations. While there will be some changes in the relative traffic growth among these destinations and in the distribution of air passengers within the region, these changes will not have a significant impact on projected traffic shares. Passenger and cargo service would continue to be concentrated at San Francisco Airport while Oakland and San Jose Airports would serve in satellite roles handling between 10% and 12% of Bay Area traffic. There would be some interstate service at these airports, but most flights would be short-haul flights to destinations in and adjacent to California.

While this alternative would generate the fewest number of flights and would be beneficial from an energy conservation standpoint, the concentration of service at San Francisco results in substantial and largely unacceptable levels of air and surface traffic congestion. Forecasted noise and air quality effects would be the most severe of any alternative.

Alternative 2. Airline Plan

The airlines have expressed their airport development policy through various reports issued by the Air Transport Association. In essence airlines endorse the concept of utilizing San Francisco Airport to its fullest before major expansion takes place at San Jose or Oakland Airports. Emphasis would then be placed on expansion of Oakland because of its overall potential for meeting long-range demand. Requirements for more terminal space, saturation of ground access facilities, and increasing runway and airspace delays at San Francisco would presumably provide the initial impetus for carriers to switch flights to Oakland. The "saturation" level has been assumed to be 31 million annual passengers. It was further assumed that traffic levels at San Jose Airport would remain the same as in Alternative 1.

Some ground access improvements would be required at Oakland and the terminal would need to be expanded. It is assumed that "new" Oakland demand represents East Bay air travelers who would normally have used San Francisco Airport.

Compared to Alternative 1, Alternative 2 will generate a larger number of Bay Area flights but will reduce negative regional noise and air quality effects due to 1) greater utilization of Oakland, with its overwater approaches and departures, and 2) reduced airport ground access distances resulting in lower auto emissions.

Figure V-3

1987 AIR PASSENGER VOLUMES BY ALTERNATIVE
(MILLIONS OF ANNUAL PASSENGERS)

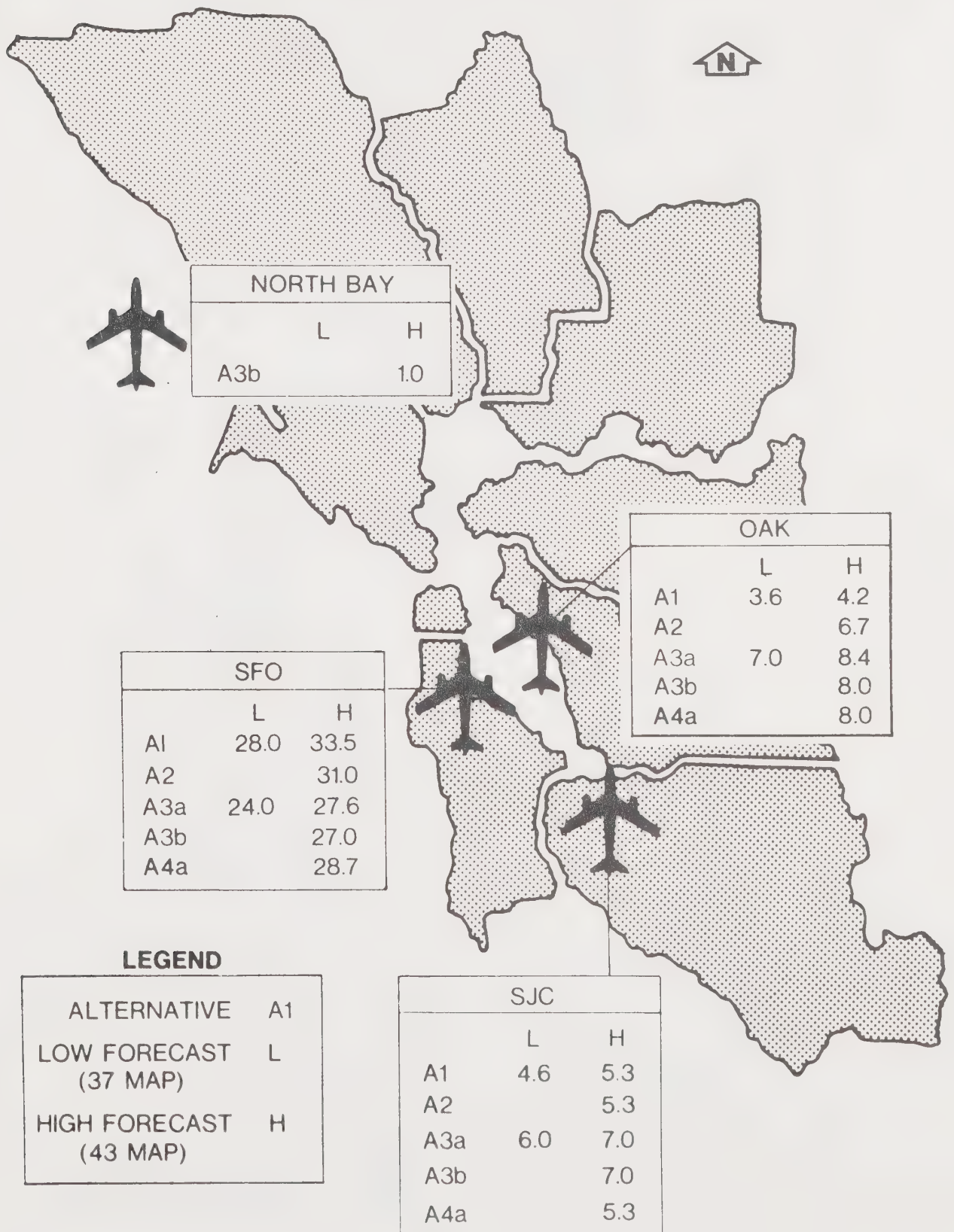
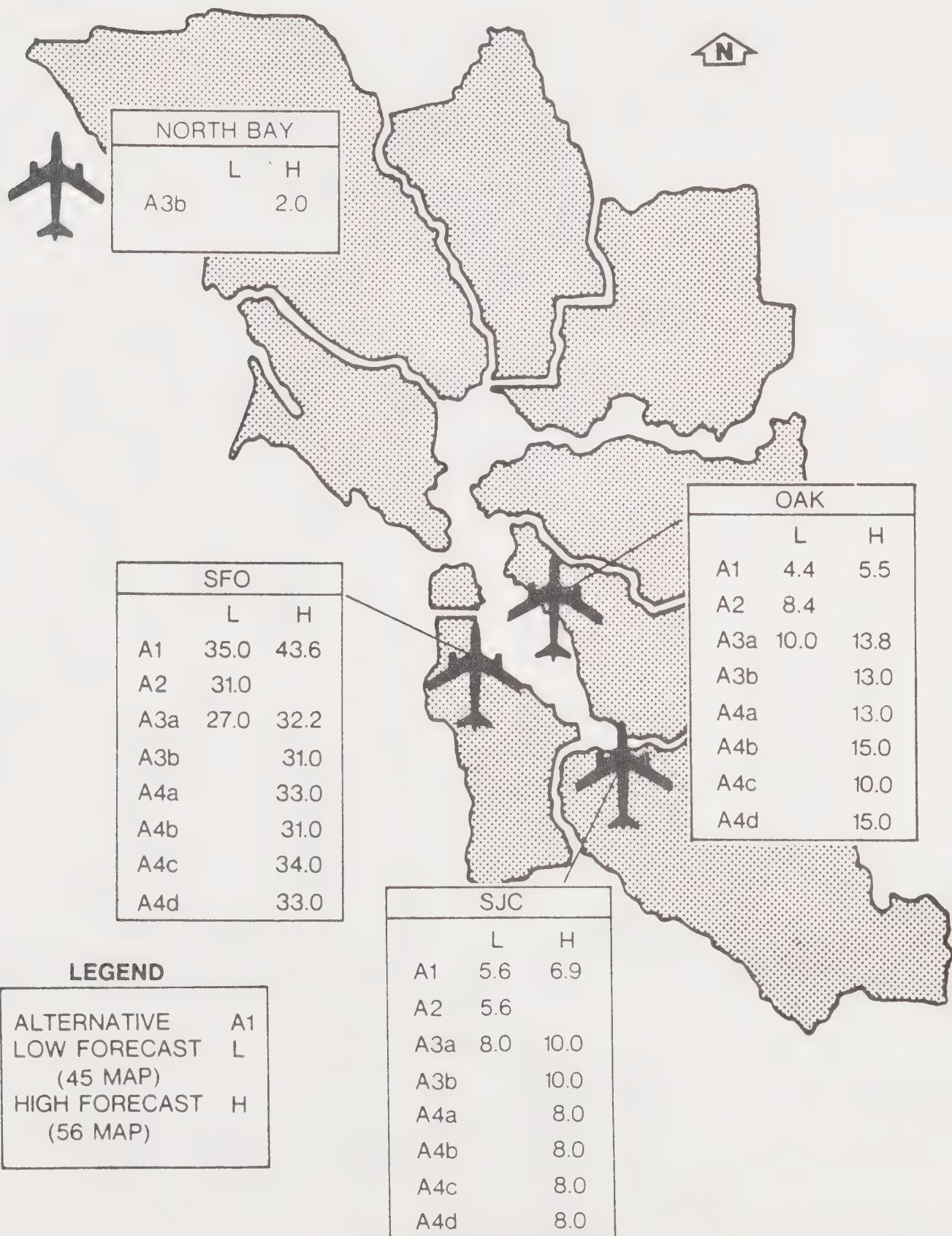


Figure V- 4
1997 AIR PASSENGER VOLUMES BY ALTERNATIVE
 (MILLIONS OF ANNUAL PASSENGERS)



Alternatives 3a and 3b. Regional Airport Plan

Alternatives 3a and 3b represent the current proposal in the adopted Regional Transportation Plan. Oakland and San Jose would serve a substantial portion of the projected air travel demand within the areas most accessible to these airports. (Oakland Airport's service area would include downtown San Francisco in order to match traffic levels to the policy recommendations adopted by RAPC.) Under this alternative, projected demand would support service between Oakland and San Jose airports and various medium to long-range destinations such as Chicago, Denver, Atlanta, Phoenix, Dallas/Ft. Worth, Minneapolis-St. Paul, New York, Washington D.C., and Hawaii. Some service would continue to be provided solely at San Francisco Airport because of insufficient demand at Oakland and San Jose Airports. At 13 million annual passengers, Oakland's traffic could still be accommodated on a single runway. San Jose would serve 10 million annual passengers in 1997.

Alternative 3 has been further divided into Alternatives 3a and 3b in order to quantify the tradeoffs associated with a North Bay airport. Alternative 3a expands service at Oakland and San Jose but does not include a North Bay Airport. Alternative 3b adds the North Bay airport, which would serve up to 2 million annual intrastate passengers in 1997. Projected demand for the four North Bay airports is shown below.

PROJECTED NORTH BAY AIRPORT DEMAND

(Annual Passengers)

<u>Airport</u>	1987		1997	
	<u>Low</u>	<u>High</u>	<u>Low</u>	<u>High</u>
Hamilton AFB	978,900	1,137,600	1,451,600	1,806,000
Sonoma County	546,300	634,900	845,600	1,052,200
Napa County	688,000	799,500	1,078,200	1,341,700
Travis AFB	305,000	355,500	519,600	646,600

Note: This demand was determined solely on the basis of total travel demand in the Southern California market and on the basis of accessibility of the North Bay airports relative to San Francisco and Oakland airports.

The distribution of Bay Area demand in Alternatives 3a and 3b would provide a more rational and convenient system from the user's standpoint. Total regional noise exposure and air pollution would be minimized. Energy consumption would be minimized with respect to aircraft delays and ground access, but total energy consumption (including energy consumed by aircraft in flight) would be higher than either Alternative 1 or 2.

Alternatives 4a-4d. San Jose Airport Constrained

For both physical and environmental reasons, the regional policy allocating up to 10 million annual passengers at San Jose in 1997 needs to be carefully reviewed. Alternative 4 consists of a range of options to "reallocate" 1.7 - 2.0 million annual passengers to other Bay Area airports. These alternatives are designated 4a-4d. In Alternative 4a, the overflow is absorbed at San Francisco Airport. Alternative 4b accommodates the overflow at Oakland Airport. A North Bay airport is expanded in Alternative 4c in order to relieve both San Francisco and Oakland Airports and limit their activity to 31 and 13 million annual passengers, respectively. (Prior to this alternative, only California intrastate service has been considered at a North Bay airport. Travis AFB was identified in the earlier study as a potential site to handle regional overflow because of its runway and airspace capability and compatibility of surrounding land use.) In contrast to the preceding alternatives, Alternative 4d assumes that all of the overflow from San Jose is absorbed at existing airports, raising the regional policy limits for San Francisco and Oakland Airports to 33 and 15 million annual passengers respectively. It also eliminates the North Bay airport.

Summary of Forecasts for Alternatives

Tables V-1 to V-3 summarize the forecasts of passengers, air cargo, and aircraft operations for each alternative and forecast level.

TABLE V-1

PASSENGER ASSIGNMENTS BY AIRPORT AND ALTERNATIVE

(Millions of Annual Passengers)

<u>Year</u>	<u>Forecast Range</u>	<u>Alternative</u>	<u>San Francisco</u>	<u>Oakland</u>	<u>San Jose</u>	<u>North Bay</u>	<u>Total</u>	<u>Average Distance</u>
1977		Existing	18.9	2.5	3.1	*	24.5	19.9
1987	Low	1	28.8	3.6	4.6	*	37.0	21.9
		3a	24.0	7.0	6.0	*	37.0	18.6
	High	1	33.5	4.2	5.3	*	43.0	21.9
		2	31.0	6.7	5.3	*	43.0	20.2
		3a	27.6	8.4	7.0	*	43.0	18.5
		3b	27.0	8.0	7.0	1.0	43.0	17.6
		4a	28.7	8.0	5.3	1.0	43.0	17.9
1997	Low	1	35.0	4.4	5.6	*	45.0	23.2
		2	31.0	8.4	5.6	*	45.0	21.1
		3a	27.0	10.0	8.0	*	45.0	19.5
	High	1	43.6	5.5	6.9	*	56.0	23.2
		3a	32.2	13.8	10.0	*	56.0	19.3
		3b	31.0	13.0	10.0	2.0	56.0	18.5
		4a	33.0	13.0	8.0	2.0	56.0	19.6
		4b	31.0	15.0	8.0	2.0	56.0	19.6
		4c	34.0	10.0	8.0	4.0	56.0	20.3
		4d	33.0	15.0	8.0	*	56.0	20.6

Notes: 1) Excludes "through" Passengers.

2) Average Distance is average distance in miles for all passengers to all airports.

Alternative 1 - Existing Airport Shares

Alternative 2 - Airline Plan

Alternative 3 - Regional Airport Plan

Alternative 3b - Regional Airport Plan with North Bay

Alternative 4 - San Jose Constrained

TABLE V-2

AIR CARGO FORECASTS BY AIRPORT AND ALTERNATIVE

(Thousands of Tons On and Off)

<u>Year</u>	<u>Forecast Range</u>	<u>Alternative</u>	<u>San Francisco</u>	<u>Oakland</u>	<u>San Jose</u>	<u>North Bay</u>	<u>Total</u>
1977		Existing	470.1	7.9	12.2	*	490.2
1987	Low	1	765.5	10.3	14.2	*	790.0
		3a	717.3	39.5	33.2	*	790.0
	High	1	808.2	10.8	15.0	*	834.0
		2	779.0	31.6	23.4	*	834.0
		3a	775.6	42.5	35.9	*	834.0
		3b	752.7	42.5	35.9	2.9	834.0
		4a	765.2	42.5	23.4	2.9	834.0
1997	Low	1	1,245.2	16.5	23.3	*	1,285.0
		2	1,184.5	61.6	38.9	*	1,285.0
		3a	1,137.3	87.3	60.4	*	1,285.0
	High	1	1,729.8	22.9	32.3	*	1,785.0
		3a	1,529.8	150.5	104.7	*	1,785.0
		3b	1,524.4	150.5	104.7	5.4	1,785.0
		4a	1,564.7	139.9	75.0	5.4	1,785.0
		4b	1,531.4	173.2	75.0	5.4	1,785.0
		4c	1,583.0	120.0	75.0	7.0	1,785.0
		4d	1,549.7	160.3	75.0	*	1,785.0

Note: Includes Air Freight and Air Mail.

Alternative 1 - Existing Airport Shares
 Alternative 2 - Airline Plan
 Alternative 3 - Regional Airport Plan
 Alternative 3b - Regional Airport Plan with North Bay
 Alternative 4 - San Jose Constrained

TABLE V-3

AIRCRAFT OPERATIONS BY AIRPORT AND ALTERNATIVE

(Thousands of Annual Operations)

<u>Year</u>	<u>Forecast Range</u>	<u>Alternative</u>	<u>San Francisco</u>	<u>Oakland</u>	<u>San Jose</u>	<u>North Bay</u>	<u>Total</u>
1977		Existing	256.3	43.7	58.0	*	385.0
1987	Low	1	292.9	46.0	66.6	*	405.5
		3a	248.3	89.4	85.6	*	423.3
	High	1	330.3	55.3	75.0	*	460.6
		2	307.6	84.8	74.9	*	467.3
		3a	276.8	106.5	97.8	*	481.1
		3b	271.2	104.0	97.8	11.7	484.7
		4a	287.0	104.0	74.9	11.7	477.6
1997	Low	1	324.7	46.3	57.6	*	428.6
		2	289.8	83.9	57.0	*	430.7
		3a	257.4	98.6	81.8	*	437.8
	High	1	383.2	57.7	71.0	*	511.9
		3a	291.4	134.0	102.0	*	527.6
		3b	281.9	126.5	102.2	21.9	532.5
		4a	296.6	126.5	82.6	21.9	505.6
		4b	279.8	145.8	82.6	21.9	530.1
		4c	304.5	100.7	82.6	42.3	530.1
		4d	296.8	145.2	82.6	*	524.6

Note: Includes all-cargo, positioning, non revenue and charter flights, but not flights by Commuter Air Carriers (Third Level Air Carriers).

D. EVALUATION OF NORTH BAY AIRPORT SITES

The Regional Transportation Plan recognizes the long-range potential for limited airline service at one or more existing airports in the North Bay. These airports include Hamilton AFB, Sonoma County Airport, Napa County Airport, and Travis AFB. Having been surplused by the military, Hamilton AFB was turned over to the General Services Administration for disposal. It is unclear whether aviation use will be retained.

Travis AFB was the subject of a joint MTC-Solano County feasibility study. The Solano County Board of Supervisors endorsed the following recommendation from the Travis AFB feasibility study:

"That Travis Air Force Base represents a valuable aviation resource to the County and the Bay Area and that necessary planning be undertaken to preserve its future availability as an airport. That the County continue to keep in effect its joint use agreement with the Air Force. That at the appropriate time to be determined in the preliminary planning process, a staff promotional program to determine the interest of air carriers be initiated."

Napa County Airport was deleted as a potential site by MTC in 1975, but because of a subsequent plan revision, it must be considered a candidate for further study at least. By unanimous Board resolution, Napa County opposes the use of Napa County Airport for air carrier service. Sonoma County Airport has received service at one time from Hughes Airwest.

Based on data prepared in the MTC-Solano County Travis AFB Study, airport master plans, and various reports prepared on Hamilton AFB, it is possible to provide generalized comparisons of the four sites. This evaluation is summarized in Table V-4, and considers the following factors:

- Potential Demand
 - Runway Capability
 - Airspace Capability
 - Terminal Requirements
 - Access Requirements
 - Surrounding Land Use
 - Noise
 - Air Quality
 - Other
-
- **Passenger Convenience.** Hamilton AFB was found to be the most convenient site for the majority of intrastate travelers in the North Bay. Passenger projections would be lower at other airports because Oakland or San Francisco would be more convenient for some passengers. None of the airports would serve a large portion of forecasted regional demand. Service at two North Bay airports would reduce the forecasted demand levels shown in Table V-4.

- **Runway Capability.** Travis AFB has the most desirable facilities for air carrier operations, while Napa Airport has the least desirable. Frequent activity by air carriers at Sonoma County Airport would probably require runway lengthening and strengthening. Travis AFB has a unique capability to provide long-term capacity relief for the Bay Area by accommodating larger aircraft types. However, it also has the disadvantages of a remote site.
- **Airspace Capacity.** Airspace capacity would not be a constraint with any of the sites. The airspace adjacent to Hamilton would need to be restored to one of its previous configurations (with a TRACON shelf over Hamilton Approach airspace at 4000 feet and below) for an ILS to be re-established.
- **Terminal Requirements.** A terminal could be developed at Hamilton AFB by remodeling one of the existing hangars. Present terminals at Sonoma County and Napa County airports would have to be extensively modified or new structures built. The Travis AFB Feasibility Study determined that the best alternative for a civilian terminal would be a new building on the southwest corner of the airbase, separate from the existing military passenger terminal.
- **Ground Access.** At Hamilton AFB, airport traffic would have to use Route 101, a heavily traveled commute facility serving the Golden Gate travel corridor. At Travis AFB traffic would have to use Route 12 which presently goes through central Fairfield.
- **Surrounding Land Use.** Travis AFB, Napa County, and Sonoma County Airports are surrounded by land that is primarily used for agriculture. Some pressures are also being experienced at these airports due to development proposals in surrounding areas. Hamilton AFB is near several communities that have expressed concern over possible noise impacts from air carrier operations. A residential development encroaches on the airport to the northeast of the runway.
- **Noise Impacts.** Given the limited number of operations in 1987 and 1997 coupled with the use of Part 36 or quieter aircraft, there are no significant noise impacts projected within the 65 CNEL contour for any of the airport sites. This conclusion assumes a continuation of existing land use around each of the airports.
- **Air Quality.** There are some differences between sites with respect to air quality. The air quality report prepared for the earlier Regional Airport System Study by the Bay Area Air Pollution Control District (now Bay Area Air Quality Management District) rated each site with respect to local climatological and meteorological conditions. The attached table shows the number of days the oxidant standard was exceeded between 1970-1974. Based on air quality studies at the three major airports, any contribution from aircraft and automobile emissions to local area air pollution would not be significant at the traffic levels contemplated in the regional plan.

- **Costs.** Capital costs have not been estimated for any airport other than Travis AFB. The estimated cost to construct the necessary access, parking, terminal, and airfield facilities on the southwest corner of the airbase was \$20.6 million (in 1975 dollars).
- **Other.** Hamilton AFB lies in a flood plain and was constructed on Bay mud. Hence drainage problems and settlement conditions could lead to higher operating and maintenance costs at this site.

Table V-4
COMPARISON OF NORTH BAY AIRPORT SITES

AIRPORT	PASSENGER PROJECTIONS		RUNWAY CAPABILITIES	AIRSPACE	GROUND ACCESS	TERMINAL FACILITIES	SURROUNDING LAND USE	NOISE	AIR QUALITY	OTHER REMARKS	EVALUATION
	1987	1997									
Hamilton	1,137,600	1,806,100	<ul style="list-style-type: none"> Adequate capacity available for limited air carrier activity Runway can accommodate B-727 type aircraft (maximum takeoff weights would be limited) ILS removed by military 	<ul style="list-style-type: none"> Airspace would need to be re-stored to previous configuration to re-establish ILS 	<ul style="list-style-type: none"> Regional traffic on Rte. 101 will increase in the future Access to Rte. 101 is awkward 	<ul style="list-style-type: none"> Existing hangers could be refurbished 	<ul style="list-style-type: none"> The Bel Marin Keys development is within one mile of the airport & other sensitive communities are in close proximity to the airport The Bay is to the east 	<ul style="list-style-type: none"> Only minor impacts are projected using Part 36 aircraft 	<ul style="list-style-type: none"> Site pollution potential: high due to light winds & sheltered location Average days oxidant standard is exceeded = 8 (San Rafael Station) 	<ul style="list-style-type: none"> The airfield is located on Bay mud & is subject to differential settlement: the dikes must be maintained to avoid flooding 	<ul style="list-style-type: none"> Most convenient Possible renovation of utilities and dikes Highest potential for noise complaints
Sonoma Co.	634,000	1,052,000	<ul style="list-style-type: none"> Adequate capacity available for limited air carrier activity Potential need to lengthen & strengthen runways to serve DC-9, B-737 aircraft ILS available 	<ul style="list-style-type: none"> No constraint 	<ul style="list-style-type: none"> Widening of Airport Blvd. may be required to serve airport & light industrial development in airport area 	<ul style="list-style-type: none"> Existing terminal inadequate 	<ul style="list-style-type: none"> Primarily agricultural with scattered low density residential development north of airport 	<ul style="list-style-type: none"> Only minor impacts are projected using Part 36 aircraft: impacts would relate to Windsor area 	<ul style="list-style-type: none"> Site pollution potential: high due to light winds. Current levels are low due to absence of major sources Average days oxidant standard is exceeded = 0 (Santa Rosa Station) 		<ul style="list-style-type: none"> Relatively inconvenient Acceptable facilities No significant environmental problems
Napa Co.	799,500	1,341,700	<ul style="list-style-type: none"> Adequate capacity available for limited air carrier activity Existing runway downgraded by County to 50,000 dual wheel load. Strength not sufficient to accommodate DC-9, B-737 aircraft Airport has instrument approach & partial ILS 	<ul style="list-style-type: none"> No constraint 	<ul style="list-style-type: none"> Modifications to access road required 	<ul style="list-style-type: none"> Existing terminal inadequate 	<ul style="list-style-type: none"> Entirely agricultural 		<ul style="list-style-type: none"> Site pollution potential: low but prevailing wind from south will blow pollutants into Napa Valley where pollutant potential is high Average days oxidant standard is exceeded = 16 (Napa Station) 		<ul style="list-style-type: none"> Relatively convenient Inadequate facilities No significant environmental problems
Travis	355,500	646,600	<ul style="list-style-type: none"> Adequate capacity is available for joint civil & military operations Runways can accept all existing types of aircraft Runways are completely instrumented for operations in all weather conditions 	<ul style="list-style-type: none"> No constraint 	<ul style="list-style-type: none"> Access is constrained by existing airbase roadway Proposed terminal location would have convenient access from Rte. 12 	<ul style="list-style-type: none"> Existing ticketing & baggage areas would require considerable modification New civilian terminal recommended on SE corner of airbase 	<ul style="list-style-type: none"> Primarily agricultural & marsh land (Suisun Marsh) 	<ul style="list-style-type: none"> Civil aircraft will not significantly impact noise contours Expansion of Suisun City may encroach on 65 CNEL noise boundary Air Force reduced overflight noise by shifting flight paths 	<ul style="list-style-type: none"> Site pollution potential: low most of year due to high wind speeds Average days oxidant standard is exceeded = 16 (Fairfield Station) 	<ul style="list-style-type: none"> Travis AFB feasibility study recommended strong action be taken to protect airport from future encroachment 	<ul style="list-style-type: none"> Least convenient Best facilities No significant environmental problems

E. PROPOSALS

North Bay Alternatives

The Committee considered four possible recommendations:

- 1) Continue the existing policy which makes any change in the Regional Transportation Plan's allocation of traffic to the North Bay contingent on a cooperative study of aviation requirements in the North Bay. All North Bay airports would be retained as potential sites until such time as this study was accomplished.
- 2) Select the preferred site(s).
- 3) Select the preferred site with conditions. This recommendation would hold the long range intrastate service option open while supporting limitations on interim types of activity. For instance, RAPC might select a preferred site and agree to limiting activity to general aviation and third level airline operations for a period of 5-10 years. After this period, discussion would take place between regional and local government as to the role of the airport in the next five to ten years.
- 4) Delete the North Bay Airport option. This option would require existing Bay Area airports to fulfill all future aviation needs in the region and may result in a) higher than desired noise impacts, b) greater need to manage demand, and c) potential filling of the Bay for new runways.

After reviewing the proposals above, the Regional Airport Planning Committee selected option "a" and concurred with the need to conduct a cooperative aviation study in the North Bay involving ABAG, MTC, BCDC, and the North Bay counties and cities.

VI. AIRPORT AND AIRSPACE CAPACITY

A. ISSUES AND PROBLEMS

One of the first tasks performed for the earlier airport system study was an analysis of airport and airspace capacity. The capacity of the airport system became a key determinant in the subsequent recommendations of the Regional Airport System Study Committee. The conclusions from the original study have been re-evaluated using newly developed procedures and models for calculating airport and airspace capacity.

Nowhere is the operation of the Bay Area airports as a system more evident than in the use of the airspace. Interactions occur between a number of airports requiring use of complex operational techniques and air traffic routes to achieve present day capacity. Under instrument weather conditions (conditions when pilots maintain control of the aircraft by reference to instruments and instructions from the air traffic controllers), the capacity of the Bay Area airport system to process arriving and departing aircraft is significantly reduced. Although these conditions occur only 8% of the year, delays can be substantial.

Increased numbers of aircraft operations will produce larger and larger delays if demand is not properly managed or new capacity provided. These delays in turn will cause significant impacts on the operation of the national airport system, such as:

- Cancellation of scheduled flights
- Delays at the origin airport for flights with destinations in the San Francisco Bay Area
- Diversion of arriving aircraft to airports other than their normal destination
- Reduced airspeed during the air route phase of flight
- Delays in holding patterns at points along the air routes
- Imposition of quotas on the maximum number of aircraft that can use the airports during peak hours.

The introduction of wide-body aircraft into the airline fleet starting in the early 1970's had a significant effect on airport and airspace capacity when it was recognized that vortices from the wings of the heavier aircraft could disturb trailing aircraft. To protect aircraft from turbulence effects, aircraft were spaced farther apart depending on the size of the leading and trailing aircraft (the maximum separation occurs when a "small" aircraft of less than 12,500 lb follows a "heavy" aircraft of greater than 300,000 lb). This adjustment decreased the rate at which aircraft could be handled in the system. However, because the larger aircraft also carried more passengers, the impact on the passenger capacity of the airports was minimal.

With the advent of airline deregulation, the number of aircraft operations in the Bay Area increased significantly, particularly the number of Third Level airline operations. At airports where delays were already at critical levels, the increase in the "mix" of small aircraft resulted in a disproportionate increase in delays. The new role of third level air carriers--that of replacing larger air carriers in low density markets--will present further challenges for the nation's airport system in accommodating this activity.

The principal methods for managing future demand include: a) redistributing traffic among Bay Area airports to make better use of unused capacity, b) allocating system capacity among users during critical traffic periods as determined by demand and weather conditions, c) developing new air traffic control equipment to reduce aircraft spacing and provide greater flexibility in routing aircraft into and out of airports, d) constructing airfield improvements to speed up aircraft flows on the runways, or e) constructing new runways at existing airports. The regional study focused on the first two areas.

Finally, attention was also directed to the issue of air safety because of increased reports of near collisions in mid-air as well as the actual collision of an air carrier and a general aviation aircraft over San Diego in September, 1978. While the regional study did not address the safety of the airspace system per se, it did deal with safety-related issues such as the need for separate ILS training facilities for general aviation aircraft, the extent to which the level of general aviation activity at air carrier airports suggests the need to expand and upgrade "reliever" general aviation airports, and the extent to which general aviation training areas conflict with air carrier arrival and departure routes.

B. OPERATION OF AIRSPACE

The airspace over the nine San Francisco Bay Area counties serves a complex of airports and accommodates a wide range of airline, general aviation and military activity. Figure VI-1 shows the nine counties with the locations of existing public use and military airports.

Most of the airline and military flights in the area are conducted in accordance with instrument flight rules (IFR). Much of the general aviation traffic is conducted in accordance with visual flight rules (VFR) because of the varied nature of general aviation activities, equipment, and pilot experience.

IFR Operations

Before entering the Bay Terminal Radar Approach Control (TRACON) airspace, IFR arriving aircraft are cleared by the Air Route Traffic Control Center (ARTCC) for descent to altitudes between 6,000 feet and 11,000 feet, depending on the point of entry. As aircraft approach and enter the Bay Area, air traffic control is transferred from ARTCC to Bay TRACON which has the responsibility for controlling arriving aircraft to a final approach course for the airport of intended landing. In a radar environment, the air traffic controller accomplishes this by radar vectoring the aircraft. Arriving aircraft are separated from departing aircraft on routes that are spaced at least 3 miles apart horizontally and/or 1,000 feet apart vertically. Aircraft under TRACON control descend to approximately 2,000 feet. At 5 nautical miles out from the runway, TRACON gives clearance for final approach, and the aircraft then contacts the control tower of the destination airport.

Because the airports in the Bay TRACON airspace are close to each other, the direction of IFR aircraft operations at each airport cannot be considered independently. Two major air traffic flow plans have been established: the "West Plan" and the "Southeast Plan." Bay TRACON determines when the air traffic flow will change from one plan to the other plan and notifies each airport control tower. The decision is based primarily on weather conditions, particularly wind direction and velocity. Prevailing wind and weather conditions normally favor using the West Plan. Occasionally, a weather front approaches the Bay Area, strong winds from the south are experienced, and the Southeast Plan is put into effect. These two plans are shown in Figures VI-2 and VI-3.

VFR Operations

Unlike IFR flights, VFR flights are not controlled by the air traffic control system except in the airport traffic areas and the Terminal Control Area. The San Francisco Terminal Control Area (TCA) was created to provide additional control for the mixture of high performance air carrier aircraft with low performance general aviation VFR aircraft. The boundaries and effective altitudes of the San Francisco TCA are shown in Figure VI-4. Aircraft operating rules and pilot qualification and equipment requirements are prescribed in Federal Aviation Regulations.

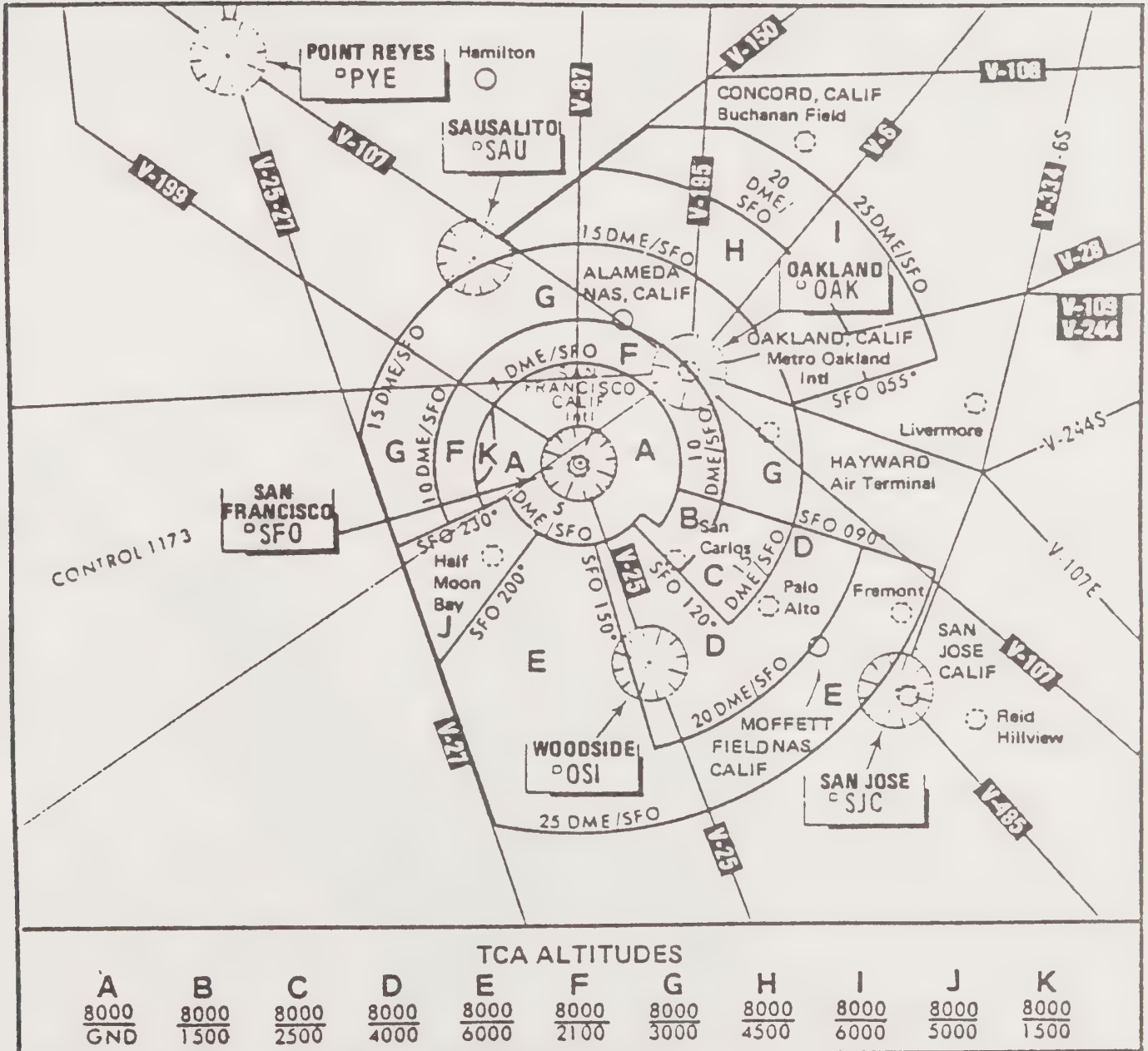
Figure VI-1
BAY AREA AIRPORTS

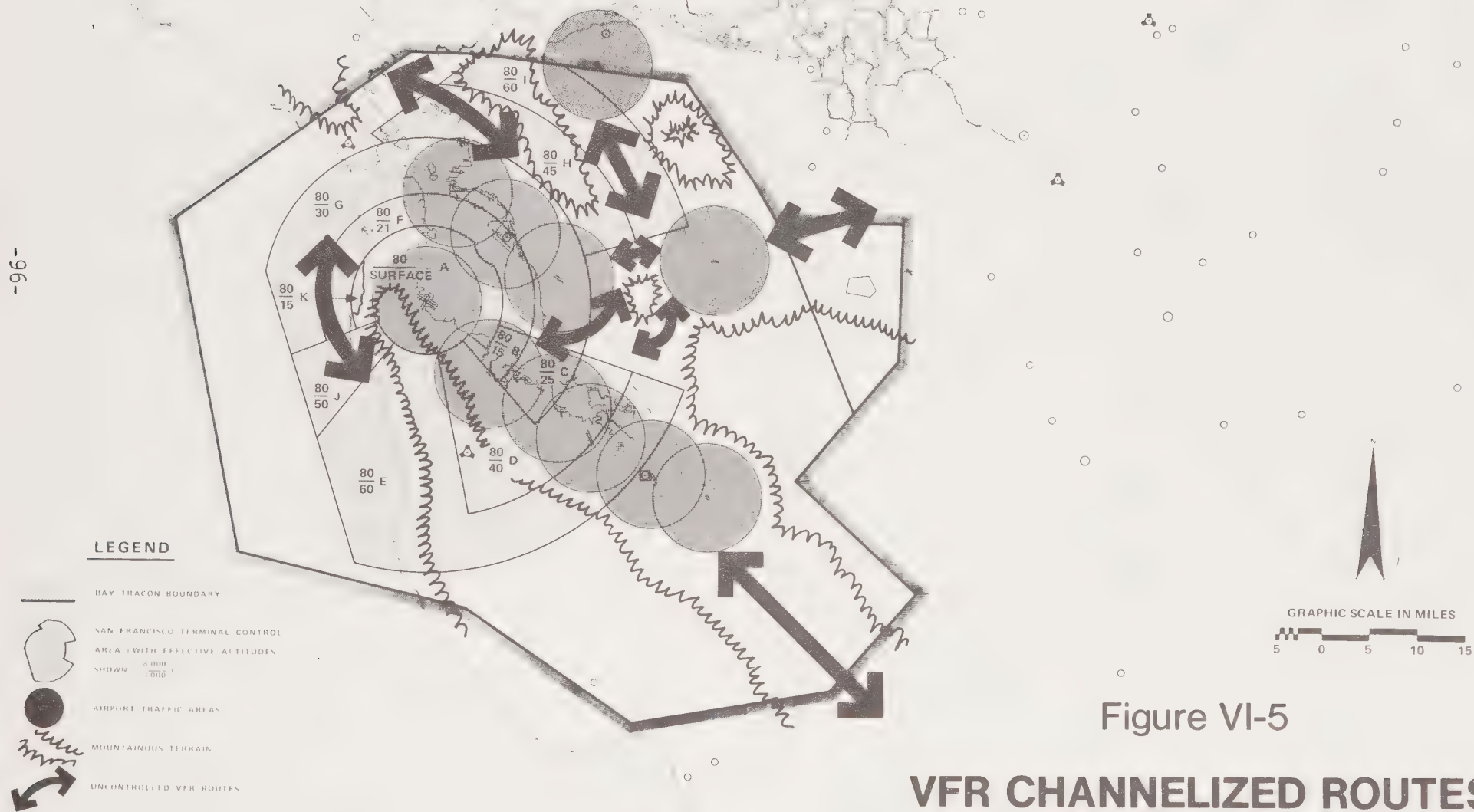




Figure VI-4

SAN FRANCISCO TERMINAL CONTROL AREA





In visual weather conditions, and outside of the San Francisco TCA and the airport traffic areas, pilots are free to navigate by visual reference and without interaction with ATC. Because of the terrain, the San Francisco TCA, and the number of airport traffic areas, the space for uncontrolled VFR flight in the Bay Area is quite limited. This limitation tends to channelize VFR traffic in certain areas. During times when low ceilings prevail, the limitations are more severe.

VFR aircraft can transit the TCA with air traffic control approval, but some do not meet equipment or pilot requirements for the TCA or simply do not wish to enter the TCA or airport traffic areas. For these aircraft it is difficult to transit the Bay Area in a northerly or southerly direction. Figure VI-5 shows the TCA, airport traffic areas, and major channelized traffic flows.

C. APPROACH

A capacity analysis was conducted for the airport runways and the airspace to determine whether the forecasted demand could be accommodated. These two analyses are discussed separately below.

Runway Capacity

- **Capacity.** Runway capacity was calculated at each airport using a new methodology recommended by the FAA for determining Annual Service Volume. Annual Service Volume is the theoretical capacity of an airport's runways measured in annual aircraft operations under a specific set of assumptions. The concept of Annual Service Volume is based on the observed phenomenon that, at a certain level of activity, the average delay to aircraft during the year will increase rapidly with relatively small increases in aircraft operations. The level of operations at which delay begins to increase rapidly is called the Annual Service Volume. As a general rule, when annual airport activity is equal to the Annual Service Volume, the average delay to each aircraft throughout the year is on the order of one to four minutes.

Runway capacity is a function of two separate variables, one that describes the physical capacity of the facility measured in operations per hour, and one that describes the pattern of airport activity throughout the year. Important considerations in determining an airport's "weighted" hourly capacity are the:

- mix of aircraft types (B-747, DC-10, B-727, general aviation, etc.)
- runway configuration and use
- availability and location of runway exits
- arrival/departure ratio
- weather conditions (visual or instrument weather)
- instrument approach aids
- percentage of training activity
- air traffic control procedures

Important considerations in describing the pattern of airport use are the hourly and daily peaking characteristics of airport users. The "flatter" the activity curve throughout the day and the year the higher the runway utilization will be and the higher the calculated capacity.

- **Delay.** Once the capacity of the airfield is computed, the delay to aircraft using the airfield can be calculated for any given level of aircraft activity. Delay is important since it measures the efficiency of the system. Delay also represents a wastage of real resources in the form of money and fuel. For instance, considering air carrier operations, the average direct operating cost for the existing regional airline fleet mix is approximately \$1,050 per hour of delay.

Airspace Capacity

- **Capacity Model.** Airspace capacity is defined as the maximum number of aircraft operations that can be served by the airspace system in one hour.

An airspace capacity model was used by Peat, Marwick, Mitchell and Co. under contract to MTC to estimate the capacity of the Bay Area airspace. An airspace network was established by dividing the airspace into elements, called nodes and links, between airports and arrival and departure fixes. The characteristics associated with each network element are defined in terms of distance, aircraft flow distributions, clearance times, separation requirements between aircraft, etc.

The airspace capacity model compared these airspace network characteristics with the characteristics of aircraft operating in the airspace (such as aircraft velocity, descent and climbout performance), resulting in a computation of airspace capacity for a particular set of operating conditions. Aircraft are grouped into A, B, C, and D classifications according to their performance characteristics in the air traffic control environment. A and B aircraft are small aircraft (maximum gross take-off weight less than 12,500 pounds); C are large aircraft (maximum gross take-off weight between 12,500 and 300,000 pounds); and D are heavy aircraft (maximum gross take-off weight greater than 300,000 pounds).

In addition to total airspace system capacity, capacities were obtained for each element in the system. Bottlenecks or critical points were identified by comparing demand with capacity for each element in the system.

Information on existing activity levels was obtained from a week-long survey at the FAA's Air Route Traffic Control Center in Fremont.

- **Assumptions.** The 1997 analysis year was selected because it represents the peak demand on the system. Capacities were determined for two periods of the day, the departure peak that occurs in the morning and the arrival peak that occurs in the evening. Additionally, the capacities for these two periods of the day were determined for two weather conditions. The "worst case" condition assumes the entire system would be operating under instrument flight rules. The other weather condition is a more prevalent case where instrument flight rule conditions exist above 3,000 feet but visual flight rule conditions exist below 3,000 feet. The West Plan was used for the basecase traffic flow condition as this plan is in operation about 90% of the year.

- **Airport System Alternatives.** The capacity model was used to evaluate several different airport system alternatives in 1997. The alternatives evaluated represent substantially different distributions of traffic within the airspace system.

- Alternative 1. Alternative 1 maintains the same relative distribution of passengers among the Bay Area airports that exists today.
- Alternative 3b. Alternative 3b assumes air service is significantly improved and expanded at Oakland and San Jose Airports. Also, a portion of the regional demand is served at a North Bay airport.
- Alternative X. (Balanced System). Alternative X redistributes additional traffic from San Francisco to Oakland and San Jose to achieve a balance in the demand/capacity ratio at each airport.
- Alternative Y. (Demand Accommodation). Alternative Y redistributes additional traffic from San Francisco, Oakland and San Jose to a North Bay airport to assure that demand does not exceed IFR airspace capacity.

D. FINDINGS

Runway Capacity

- **San Francisco Airport.** The crossing runway pattern at San Francisco Airport permits the airfield to be operated in a number of different configurations depending on wind direction and ceiling and visibility conditions. During peak activity periods and during good weather, runway capacity using 28L and 28R for arrivals and 1L and 1R for departures is about 110 operations per hour. All other runway configurations yield hourly capacities of about 100 operations. During instrument weather conditions, hourly capacity is reduced to 35-40 operations per hour. The weighted hourly capacity (average capacity given the percentage use of the various runway configurations) is about 79 operations per hour. Given this factor and the hourly and daily activity pattern at San Francisco, the Annual Service Volume was calculated to be about 400,000 annual operations. The theoretical allocation of capacity to air carrier and general aviation (including Third Level air carriers) is a function of the estimated demand in these two categories.

RUNWAY CAPACITY

(Annual Operations)

<u>Air Carrier Capacity</u>	<u>General Aviation Capacity</u>	<u>Total</u>
310-330,000	70-90,000	400,000

- **Oakland Airport.** (South Airport) As airline service is expanded and improved at Oakland Airport, the aircraft mix will reflect a much higher portion of wide-body aircraft than exists today. This increase would have a significant impact on the theoretical runway capacity due to wake turbulence separation requirements. However, as airport activity increases, the pattern of use will also change as more flights are scheduled in presently low activity periods. Thus, the lower hourly capacity will be offset by the higher annual utilization, resulting in little change in the theoretical runway capacity. The VFR hourly capacity of the main runway is approximately 50 operations per hour compared to an IFR capacity of approximately 42 operations per hour. The Annual Service Volume was estimated to be 184,000 annual operations.

RUNWAY CAPACITY

(Annual Operations)

<u>Air Carrier Capacity</u>	<u>General Aviation Capacity</u>	<u>Total</u>
144-170,000	14-40,000	184,000

- **San Jose Airport.** The runway configuration at San Jose Airport consists of three parallel northwest-southeast runways. The longest runway (12R-30L) accommodates all of the air carrier operations and general aviation jets. Runway 12L-30R is used for general aviation of all categories except jets. The shortest runway (11-29) is used for "touch and go" training activity. Local training activity is a significant portion of general aviation activity on the airport. The high proportion of touch and go activity coupled with the three runway configuration enables the airport to handle a fairly high volume of operations. The VFR hourly capacity was found to be between 308 and 322 operations per hour. Future IFR capacity showed a maximum hourly capacity of 54-56 operations per hour. The Annual Service Volume was estimated to be 770,000 operations. This analysis indicates that capacity is available for an increase in both air carrier and general aviation activity above present levels.

RUNWAY CAPACITY

(Annual Operations)

<u>Air Carrier Capacity</u>	<u>General Aviation Capacity</u>	<u>Total</u>
100-160,000	670-610,000	770,000

- **North Bay Airport.** The 1997 forecast allocates a total of 2 million annual passengers and 21,900 operations to a North Bay airport (Alternative 3b). This volume of operations is well below the airfield capacity available at Hamilton AFB, Napa County Airport, Sonoma County Airport or Travis AFB.
- **Comparison of Demand and Capacity.** Table VI-1 and Figure VI-6 compare demand and capacity for two alternatives, Alternative 1 and Alternative 3b. Alternative 1 assumes each airport continues to handle the same share of traffic as it does today while Alternative 3b assumes Oakland, San Jose, and a North Bay airport combine to handle a large share of future regional demand.

Delays

Aircraft delays will increase throughout the forecast period, as shown in Table VI-2. Comparing the airport system alternatives, it can be seen that the maximum delays occur in Alternative 1, due to the excess of demand over capacity at San Francisco Airport. Limiting access to San Francisco Airport by aircraft under 12,500 lb would result in substantial reductions in the calculated delay values for Alternative 1 as well as for other alternatives.

TABLE VI-1

COMPARISON OF AIRPORT DEMAND AND AIRFIELD CAPACITY

(Annual Aircraft Operations)

Year	Alt.	Airport	MAP	AIR CARRIER			GENERAL AVIATION			TOTAL		
				Demand	Capacity	D/C	Demand	Capacity	D/C	Demand	Capacity	D/C
1987	1	San Francisco	33.5	330,350	330,000	1.00	82,400	110,000	1.10	412,750	400,000	1.03
		Oakland	4.2	55,300	164,000	0.34	10,400	20,000	0.52	65,700	184,000	0.36
		San Jose	5.3	74,960	130,000	0.58	520,400	670,000	0.78	595,360	800,000	0.74
		Total	43.0	460,610	624,000	0.74	613,200	760,000	0.81	1,073,810	1,384,000	0.36
	3b	San Francisco	27.0	271,180	317,000	0.86	82,400	83,000	0.99	353,580	400,000	0.62
		Oakland	8.0	103,950	170,000	0.61	10,400	14,000	0.74	114,350	184,000	0.62
		San Jose	7.0	97,820	160,000	0.61	520,400	640,000	0.81	618,220	800,000	0.77
		Total	42.0*	472,950	647,000	0.73	613,200	737,000	0.83	1,086,150	1,384,000	0.78
1997	1	San Francisco	43.6	383,250	328,000	1.17	92,740	72,000	1.29	475,990	400,000	1.19
		Oakland	5.5	57,700	144,000	0.40	22,810	40,000	0.57	80,510	184,000	0.44
		San Jose	6.9	70,960	100,000	0.71	610,120	670,000	0.91	681,080	770,000	0.88
		Total	56.0	511,910	572,000	0.89	725,670	782,000	0.93	1,237,580	1,354,000	0.91
	3b	San Francisco	31.0	281,870	310,000	0.91	92,740	90,000	1.03	374,610	400,000	0.94
		Oakland	13.0	126,490	160,000	0.79	22,810	24,000	0.95	149,300	184,000	0.81
		San Jose	10.0	102,230	130,000	0.79	610,120	640,000	0.95	712,350	770,000	0.93
		Total	54.0*	510,590	600,000	0.85	725,670	754,000	0.96	1,236,260	1,354,000	0.91
1977		San Francisco		256,310	310,000	0.83	88,470	90,000	0.98	344,780	400,000	0.86
		Oakland		43,700	170,000	0.26	5,000	14,000	0.36	48,700	184,000	0.26
		San Jose		60,550	130,000	0.47	409,600	640,000	0.64	470,150	770,000	0.61
		Total		360,560	610,000	0.58	503,070	744,000	0.68	863,630	1,354,000	0.64

Notes: *1.0 MAP in North Bay in 1987 and 2.0 MAP in 1997

D/C = Demand/Capacity

MAP = Millions of Annual Passengers

Oakland's capacity does not include the North Field general aviation airport

Figure VI-6
COMPARISON OF DEMAND WITH RUNWAY CAPACITY

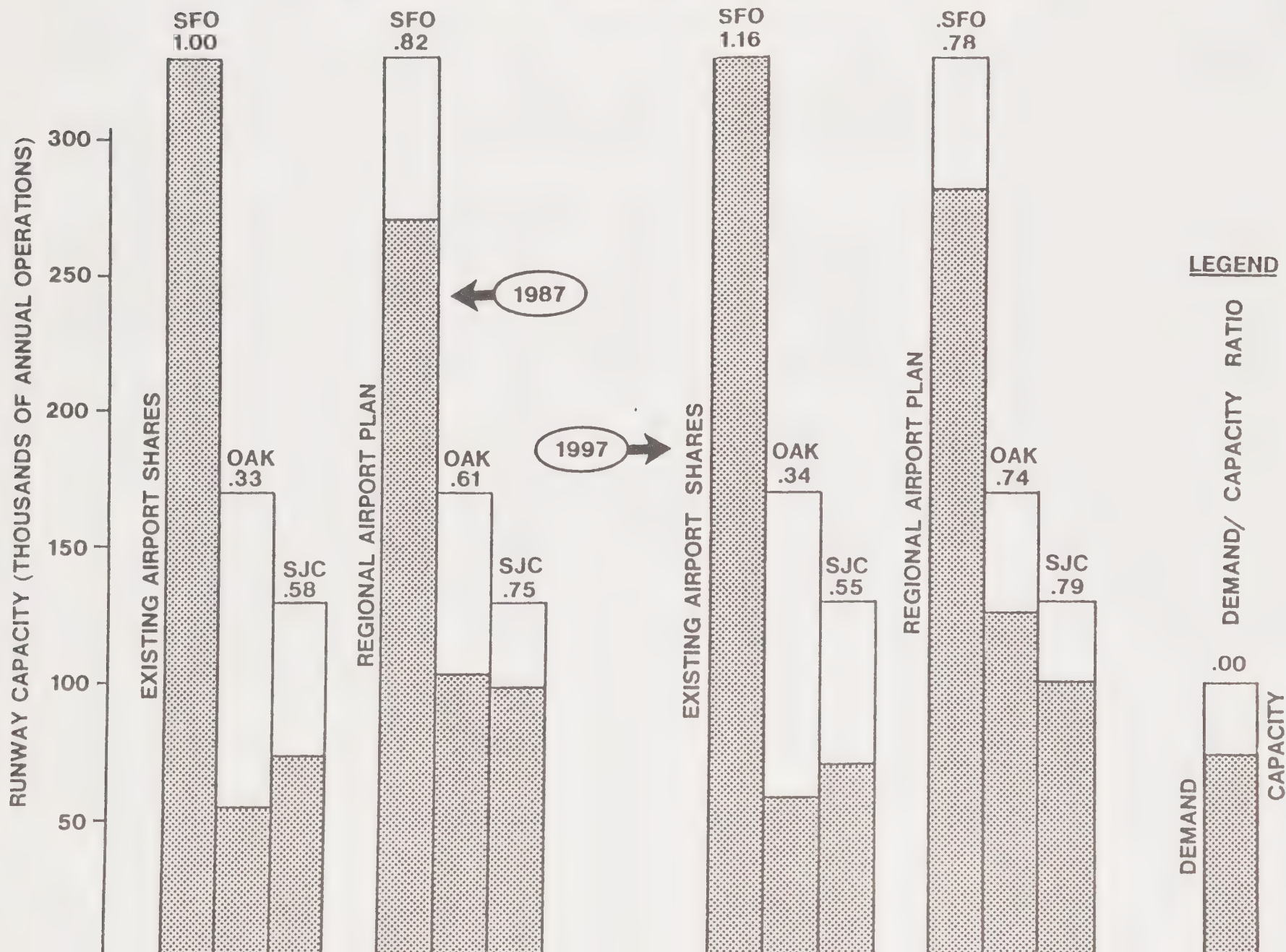


TABLE VI-2

FORECASTS OF AIR CARRIER DELAYS

(Annual Hours)

<u>Year</u>	<u>Range</u>	<u>Alt.</u>	<u>SFO</u>	<u>OAK</u>	<u>SJC</u>	<u>N.B.</u>	<u>Total</u>
1977	Existing		6,430	260	650	*	7,340
1987	Low	1	9,500	150	850	*	10,500
		3a	5,200	670	1,150	*	7,020
	High	1	17,700	220	1,000	*	18,920
		2	11,800	640	1,000	*	13,440
		3a	7,700	1,300	1,400	*	10,400
		3b	7,100	1,150	1,400	50	9,700
		4a	9,500	1,150	1,000	*	11,650
	Low	1	18,700	180	1,050	*	19,930
		2	10,000	700	1,050	*	11,750
		3a	6,400	1,250	1,700	*	9,350
	High	1	48,200	290	1,400	*	48,890
		3a	10,300	3,200	2,300	*	15,800
		3b	8,900	2,600	2,300	100	13,900
		4a	11,100	2,600	1,700	100	15,500
		4b	8,600	4,300	1,700	100	14,700
		4c	15,200	1,500	1,700	200	18,600
		4d	11,100	4,300	1,700	*	17,100

Alternative 1 - Existing Airport Shares

Alternative 2 - Airline Plan

Alternative 3 - Regional Airport Plan

Alternative 3b - Regional Airport Plan with North Bay

Alternative 4 - San Jose Constrained

Airspace Capacity

- **Forecasts of IFR Traffic.** In 1997, there will be an IFR demand of almost 200 aircraft per hour in the Bay Area airspace system in the peak hour of the average day. With the present airspace configuration, the capacity is approximately 85 aircraft per hour in IFR weather conditions. Approximately one-third of the forecasted demand will be from general aviation and military activity.

- **Comparison of Demand and Capacity.** VFR airspace capacity is about twice as large as IFR airspace capacity. An excess of demand over capacity will occur rarely in VFR weather. In VFR weather--which occurs about 8% of the year--there will be a significant excess of demand over capacity. The excess will be largest in the evening arrival peak, between 6 p.m. and 8 p.m. The excess of demand over capacity in IFR weather occurs primarily on the final approach paths to each airport, where air traffic from a number of arrival routes converges for landing.

Peak demand in 1997 will cause the airspace system to become even more congested than shown in this report, which considers only average day operations. The projected excess of demand over capacity in IFR weather will result in significant congestion in the Bay Area airspace, and delays to aircraft as high as 90 minutes will occur. It is likely that demand will regularly exceed capacity well before 1997.

COMPARISON OF 1997 DEMAND WITH AIRSPACE CAPACITY

- Arrival Peak -

<u>Alternative</u>	<u>Overall System Demand</u>	<u>IFR Conditions</u>		<u>VFR2 Conditions</u>	
		<u>Capacity</u>	<u>D/C</u>	<u>Capacity</u>	<u>D/C</u>
1	192	83	2.3	163	1.2
3	192	117	1.6	231	0.8
X	192	154	1.3	308	0.6
Y	160*	160	1.0	320	0.5

Notes: D/C = ratio of demand to capacity.

IFR Weather Ceiling: Less than 1000 feet
 Visibility: Less than 3 miles
 Frequency of Occurrence: 8% of year

VFR2 Weather Ceiling: 1000 to 6000 feet
 Visibility: 3 to 6 miles
 Frequency of Occurrence: 13% per year

Peak Arrival Period: 6 - 8 p.m.

*Thirty-two aircraft per hour are allocated to a North Bay airport outside the TRACON airspace.

- **Effects of Redistributing Airline Traffic Among Bay Area Airports.** The overall IFR system demand exceeds airspace capacity for each alternative except theoretical Alternative Y. Thus, for the 8% of the year requiring operations under instrument weather conditions, delays would be significant for all alternatives.

The redistribution of IFR traffic from San Francisco to Oakland, San Jose, and a North Bay airport would increase IFR airspace capacity from 83 operations per hour (Alternative 1) to almost 120 operations per hour (Alternative 3). There would still be a significant excess of demand over capacity even with this redistribution.

If traffic were distributed among the three Bay Area airports to "balance" the ratio of demand to capacity at each airport (i.e., attain the same ratio at each airport), IFR capacity would increase to more than 150 operations per hour. This increase would be achieved by assigning more traffic to Oakland. Even with this system there would still be a significant excess of demand over capacity.

In IFR weather, the excess of demand over capacity can be eliminated only by limiting demand, allocating a large number of aircraft operations to a North Bay airport, or by making other significant changes to the airport and airspace system such as adding new runways.

- **Potential Airspace Reliever Role of North Bay Airport.** From the preceding discussion it is evident that a North Bay airport could relieve IFR airspace congestion in the Bay Area. Air traffic destined to and from any of the four potential North Bay airports could overfly and, hence, bypass Bay TRACON airspace. Each of the four potential sites--Travis AFB, Hamilton AFB, Sonoma County and Napa County Airports--is comparable in terms of airspace capacity. However, if aircraft serving the North Bay airport were to make intermediate stops at San Francisco, Oakland, or San Jose to load additional passengers, the airspace capacity benefits of a North Bay airport would be negated. Also if flights into a North Bay airport were to take place on a random basis (i.e., during critical demand/weather conditions) passenger inconvenience could be substantial, as passengers diverted to this airport would require ground transportation back to the central Bay Area.
- **Third Level Carriers and General Aviation.** The Bay Area general aviation airport managers assisted MTC in identifying airports and airspace used for general aviation training (both IFR and VFR). Review of the responses indicates that Oakland International and San Jose Municipal Airports are used for IFR training by essentially all of the training schools in the nine-county Bay Area. These airports are used extensively for precision Instrument Landing System (ILS) training. Buchanan Field, Hayward Air Terminal, Napa County and Livermore Municipal Airports are used for nonprecision IFR training as well. Some schools in the North Bay

use Sacramento Executive Airport for ILS training; Stockton Metro Airport is used occasionally by almost all of the other training schools. However, the time lost in transit to and from these airports for training is discouraging. Air carriers also use both Oakland International and Stockton Municipal Airports for ILS training.

Relocating some of the general aviation IFR training traffic away from heavily used air carrier airports such as San Jose to other IFR airports would increase airspace safety. A review of general aviation VFR training areas shows that some VFR training areas are in the vicinity of air carrier arrival and departure routes; however, most training areas are in airspace that is not used by air carrier aircraft.

An efficient air transportation system will depend on adequate feeder service by commuter airlines into the major air carrier airports. If the growth in commuter activity continues to increase, IFR airspace capacity could be significantly reduced because of aircraft separation requirements. This adverse impact could be mitigated if commuter aircraft could operate on independent airspace routes to facilities co-located with the facilities used by large air carrier aircraft.

E. PROPOSALS

Rescheduling of Operations

When delays start to regularly approach acceptable limits, rescheduling of traffic should be considered for the peak periods. The airlines, working cooperatively, would be responsible for making adjustments to their schedules. When delays start to regularly exceed acceptable levels, additional measures should be considered to "depeak" critical periods. These methods would include a peak period quota and/or peak period pricing. Currently, four high activity airports (Chicago O'Hare, JFK, LaGuardia and Washington National) have Federally imposed quotas due to airspace and air safety constraints. At these airports airline committees allocate available slots, a practice that has been challenged under current regulatory policies as being anti-competitive. If such a quota were necessary for the Bay Area, more acceptable methods for allocating slots would be needed. Potential methods include a sealed bid auction or a sealed bid auction that worked within an initial allocation of slots to trunk, regional and third level carriers and general aviation.

Peak surcharges should also be considered by airport operators to reduce activity during critical periods. These surcharges could be imposed separately from landing fees and would be employed to encourage more rational use of airspace capacity. Only limited and not very encouraging data is available on the effectiveness of the latter strategy.

Lead Agency: Airports, FAA
Action: Monitor delays (FAA). Encourage voluntary rescheduling by the airlines as an initial approach. When delays approach critical levels, evaluate the advantages and disadvantages of the quota approach versus the congestion surcharge (Airport).
Time Frame: Medium to Long Range

Develop Reliever Airports

Reliever airports, general aviation facilities that relieve congestion at major airports, can help reduce aircraft delays. Reliever airports will become particularly important if general aviation activity at major airports is limited directly or indirectly through quotas or peak hour pricing. The ability of reliever airports to accommodate general aviation from congested air carrier airports can be limited by:

- inadequate runway length,
- lack of instrument landing system aids for poor weather conditions, and
- inadequate runway capacity.

Improvements in the region's reliever airports should be implemented to bring these airports up to their full capabilities.

Lead Agency: General Aviation Airport Operators

Supporting

Agencies: FAA, MTC

Actions: FAA - Support development of reliever airports through allocation of aviation Trust Funds.

MTC - Through the general aviation system plan and the Transportation Improvement Program, support the development of reliever airports and general aviation VFR and IFR training facilities.

Time Frame: Variable.

Develop General Aviation ILS Training Facilities

A new Instrument Landing System (ILS) at a location convenient to the majority of flight training schools could relieve Oakland International and San Jose Municipal Airports in their role as ILS training facilities for general aviation. An ILS at a general aviation airport would have the added benefit of increasing available IFR capacity at air carrier airports. Proposed FAA projects include the installation of a full ILS at Napa and Livermore airports. Other potential locations, such as, Hamilton AFB, South County, Tracy, Hollister and Watsonville should also be considered.

Lead Agency: FAA

MTC Role: Assist in coordination with local government.

Action: Review potential for ILS at various airports.
Study location and feasibility of remote sites for an ILS practice strip.

Time Frame: Short Range

Segregate Small Aircraft Traffic at Air Carrier Airports

Oakland Airport is an excellent sample of how general aviation and air carrier facilities can be separated (with the exception that jet aircraft must use the South Airport). While this degree of separation cannot be achieved at San Francisco and San Jose Airports some possibilities exist at San Francisco to further segregate small aircraft traffic. Under certain conditions, Taxiways C and L could be used as utility runways for light aircraft. The future installation of a Microwave Instrument Landing System may also provide the capability to create separate arrival and departure routes for individual runways.

Lead Agency: FAA, Airport
Action: Explore the possibility for separate facilities at San Francisco Airport for light and small aircraft.
Time Frame: Short Range

Airfield Improvements

The flow of aircraft into an airport and on the airfield can be improved by a variety of low cost measures, including, but not limited to the following:

- Aircraft holding aprons
- High speed runway turnoffs
- Modifications to the taxiway system
- Improved runway and taxiway lighting
- Upgraded equipment for instrument operations and weather reporting
- New takeoff and landing procedures
- Airport Surveillance Radar

Most of these projects would be reviewed through the A-95 process and would be considered in accordance with regional policies and project review criteria.

Lead Agency: FAA, Airport
Supporting Agency: RAPC
Action: FAA, Airport - Study measures to reduce delay.
RAPC - Review and approve airport improvement projects.
Time Frame: Short-Medium Range

The Need for Further Study

It was noted that large delays may be expected in advance of 1997, perhaps as early as 1987. This finding suggests that detailed planning will be required at an early date to resolve future airspace problems. Specific areas of investigation should include an analysis of when significant airspace delays would be expected, quantification of these delays, assessment of the cost of these delays, and evaluation of the potential methods for reducing delays. Potential improvements resulting from new technology systems such as Wake Vortex Avoidance Systems,

Microwave Landing Systems, Metering and Spacing Equipment, the Discrete Address Beacon System, also need to be quantified. The appropriate agency to conduct this study is the FAA.

The results of the regional study also point to the need to evaluate portions of the airspace to determine their potential for reconfiguration and hence for improving airspace efficiency during peak hours. During the departure peak, interactions between Oakland departures, Alameda Naval Air Station arrivals, and northbound mid-Bay traffic combine to cause congestion over Oakland. One potential airspace improvement would be to reroute some of the mid-Bay traffic from South Bay airports over airspace routes to the east that have low demand/capacity ratios. This rerouting would increase the departure capacity, and would reduce congestion in the vicinity of Oakland International Airport.

Interactions occur between Hayward, Oakland, and Alameda Naval Air Station during arrival peaks. Because of the need to protect airspace for missed approaches on Runways 27R and 29 at Oakland in some IFR weather conditions, the full capability of the approach to Runway 29 cannot be used. In turn, this protected airspace leaves sufficient gaps in the Runway 29 approach to permit IFR approaches to Hayward Air Terminal. When the weather does not require missed approach protection, arrivals into Hayward conflict with the approach to Runway 29 at Oakland. Airspace reconfiguration would be needed to relieve this conflict.

Lead Agency: FAA
Action: Detail future Bay Area airspace delays and remedial actions
Time Frame: Short Range

Review General Aviation VFR Training Areas

Review of the responses from the general aviation airport managers indicates concentrations of airborne flight training areas to the south and east of San Francisco Bay. Overlapping flight training areas exist from the San Jose area and the Santa Clara Valley northward through Newark and Fremont, into the Livermore, San Ramon, and Danville areas, to the east of coastal hills north of Tracy, and in the area of Byron and Brentwood. Air carrier IFR routes transit some of these areas. In order to assure proper spatial separation between air carrier operations and general aviation VFR training, the FAA should review altitude separation requirements with flight schools using these areas.

Lead Agency: FAA
Action: Review location and utilization of training areas
Conduct information program
Time Frame: Short Range

VII. AIRPORT GROUND ACCESS CAPACITY

A. ISSUES AND PROBLEMS

Airports are dependent on an efficient regional and local ground transportation system to provide access for passengers, their friends and relatives, employees, cargo, and other traffic to the terminal areas. Of particular concern are the street and highway facilities adjacent to the airports, which experience the combined load of growing airport traffic as well as growing urban traffic. Because of the continuing shortage of capital funds for transportation improvements in the region, more productive ways will have to be found to use existing transportation facilities and services.

References to airport ground access "problems" can mean any one of the following:

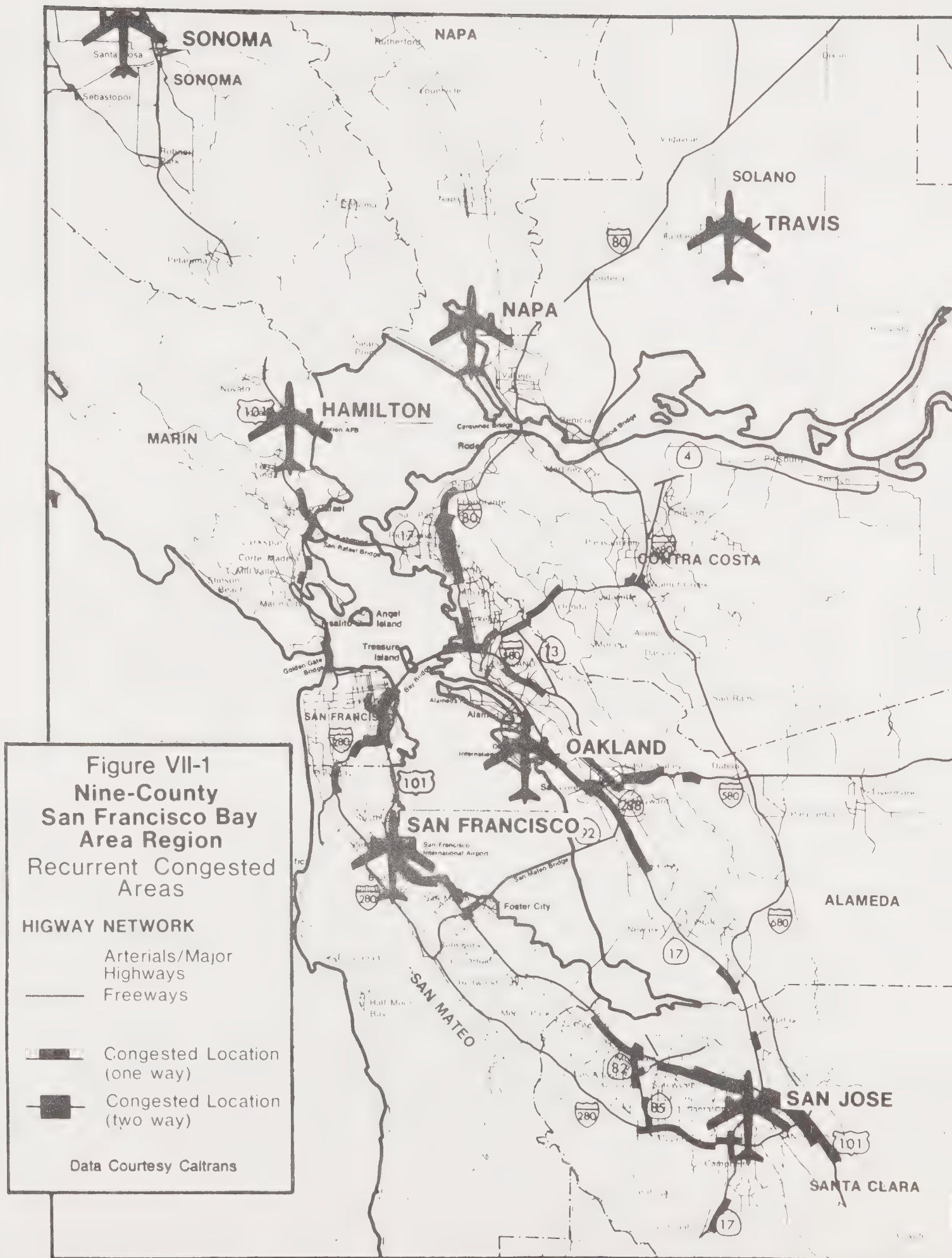
- delays in getting to and from the airports as a result of congestion on various parts of the regional transportation system, particularly in the immediate vicinity of airports
- inadequate circulation, curbspace, and parking at the airport
- limited mass transit services to the airport

Major access problems at San Francisco Airport include freeway congestion south of the airport and internal circulation on the airport property.

Major access problems at Oakland Airport include constraints on local street capacity between the airport and the Nimitz Freeway and a gradual shifting of congestion northward and adjacent to the airport.

Major access problems at San Jose Airport include continuing congestion on all freeways surrounding the airport (particularly the Bayshore Freeway south of the airport) and poor access between these freeways and the airport terminal and parking areas. Another problem at San Jose Airport is the low level of transit use.

The airport access analysis consisted of estimating airport surface traffic for each airport system alternative, assigning this traffic to specific access routes, and evaluating the impact of this traffic on facilities serving the airports. Because of the number of airport system alternatives and the range in regional demand for each forecast year, there is a potential for large variation in traffic at each airport. To the extent that traffic is shifted from congested portions of the regional transportation system to less congested portions, regional transportation flows will be improved (See Figure VII-1). In general, considering both airport and non-airport traffic, the analysis indicates the potential for continuing and most likely increasing congestion during peak urban travel periods in the vicinity of all airports.



Although this statement may appear intuitively obvious, greater definition of the problem is elusive. Analysis of future capacity requirements must recognize the inherent dynamics of travel demand. Increasing congestion usually results in adaptive behavior on the part of users of the transportation system; that is, airport and non-airport tripmakers will tend to change access routes, modes of transportation, and/or travel schedules to minimize personal inconvenience and costs. Thus, straightforward demand/capacity comparisons can be misleading.

One of the key questions related to airport access is the potential effectiveness of various strategies to minimize airport traffic. In addition to helping relieve local traffic congestion and delay or reducing the need to construct expensive transportation facilities, these strategies would be beneficial from an energy and air quality perspective. Ground traffic mitigation measures are primarily targeted to air passengers and airport employees. ("Other" trips would be relatively unaffected by transit improvements or ride-sharing programs.)

Airport expansion and development programs have historically failed to place sufficient emphasis on methods to increase transit use and ride-sharing. There are a number of inherent problems in increasing transit use to airports--currently around 15% for air passengers and 8% for airport employees. Air passengers require services that can conveniently accommodate baggage, are fairly direct, and are extremely reliable. Employees are a good market for transit because once "captured" by transit, the employee will tend to use the service on a regular basis. Transit use and ride-sharing for employees can be somewhat complicated by odd working hours, a characteristic of multiple-shift airport operations. However, ride-sharing can be promoted fairly effectively without great expense.

Although potentially counterproductive with respect to increased transit ridership goals, providing long-term airport parking would reduce "Kiss-and-Fly" activity (friends and relatives who drop off and pick up air passengers at the airport), and would also result in fewer vehicle trips.

In some instances, new street and highway facilities will be required to improve access between the airports and existing regional highway facilities. These improvements need to be identified early on so that they can begin to compete for limited funds. For some sources of funds the competition may take place at the county level, for others at the regional or state level and for high capital-intensive projects at the national level. In California, the Legislature has set up a clearly defined process in which many of the trade-offs among competing claims for increasingly scarce resources can be made at the regional level. Thus, local communities and MTC have been given the charge to develop a financial program for highway and transit improvements that is then submitted to the California Transportation Commission and the Federal Department of Transportation for funding approval.

B. EXISTING CONDITIONS

Street and Highway Access

Each of the three Bay Area airports is located next to major urban freeways. San Francisco Airport is served by U.S. 101 and I-280 which is connected to the airport via I-380. Oakland Airport's primary freeway access is via Route 17; however, some trips are made on I-580 to the airport via Seminary Avenue or Edwards Avenue/Hegenberger Expressway. San Jose Airport is bounded by U.S. 101 on the north and Route 17 on the south.

Various arterials link each of the airports to the adjacent freeways and local street systems. The San Bruno Avenue and Millbrae Avenue interchanges at San Francisco Airport connect the airport to the surrounding communities on the west. Old Bayshore Highway and South Airport Boulevard serve to relieve U.S. 101, as some traffic diverts to these routes for access/egress to the airport. Oakland Airport is connected to Route 17 and communities to the east by the Hegenberger Expressway and by 98th Avenue. Doolittle Drive runs adjacent to the airport and provides direct access to the airport from Alameda to the north and San Leandro to the south. At San Jose Airport, the major connection to U.S. 101 is the Guadalupe Parkway. The major connection to Route 17 is via Coleman Avenue. Some traffic from the southern portion of Alameda County uses Brokaw Road to the airport from Route 17 as does some Santa Clara County traffic from the south (exiting U.S. 101 at N. 1st Street). A small portion of airport traffic to the west of the airport uses El Camino Real (Route 82) and the Central Expressway.

Airport access routes are shown in Figures VII-2 to VII-4.

Transit Access

Major transit services and current airport patronage levels are shown below.

<u>Airport</u>	<u>Service</u>	<u>Area Served</u>	<u>Approximate 1977 Daily Patronage</u>
San Francisco	Airporter	Downtown San Francisco	6,660
	SamTrans/ 3B, 7F, 7B Lines	Peninsula/ Transbay Terminal	1,200
	Marin Airporter	Marin County	170
	Berkeley Airport Connection	East Bay	50
	Evans Airporter	Napa	40
	Santa Rosa Airporter	Santa Rosa	N/A

Figure VII-2
SAN FRANCISCO AIRPORT

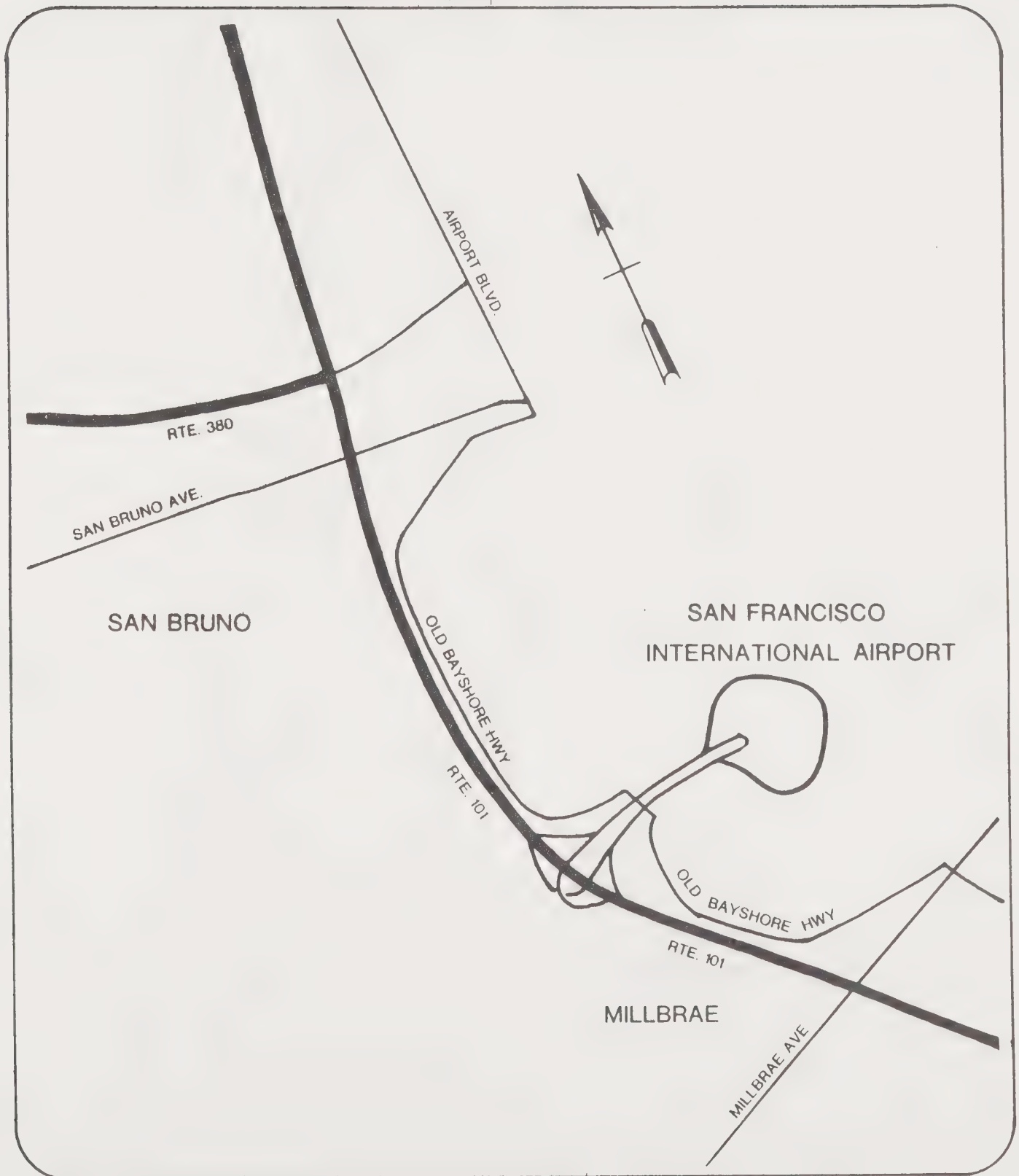


Figure VII-3
OAKLAND AIRPORT

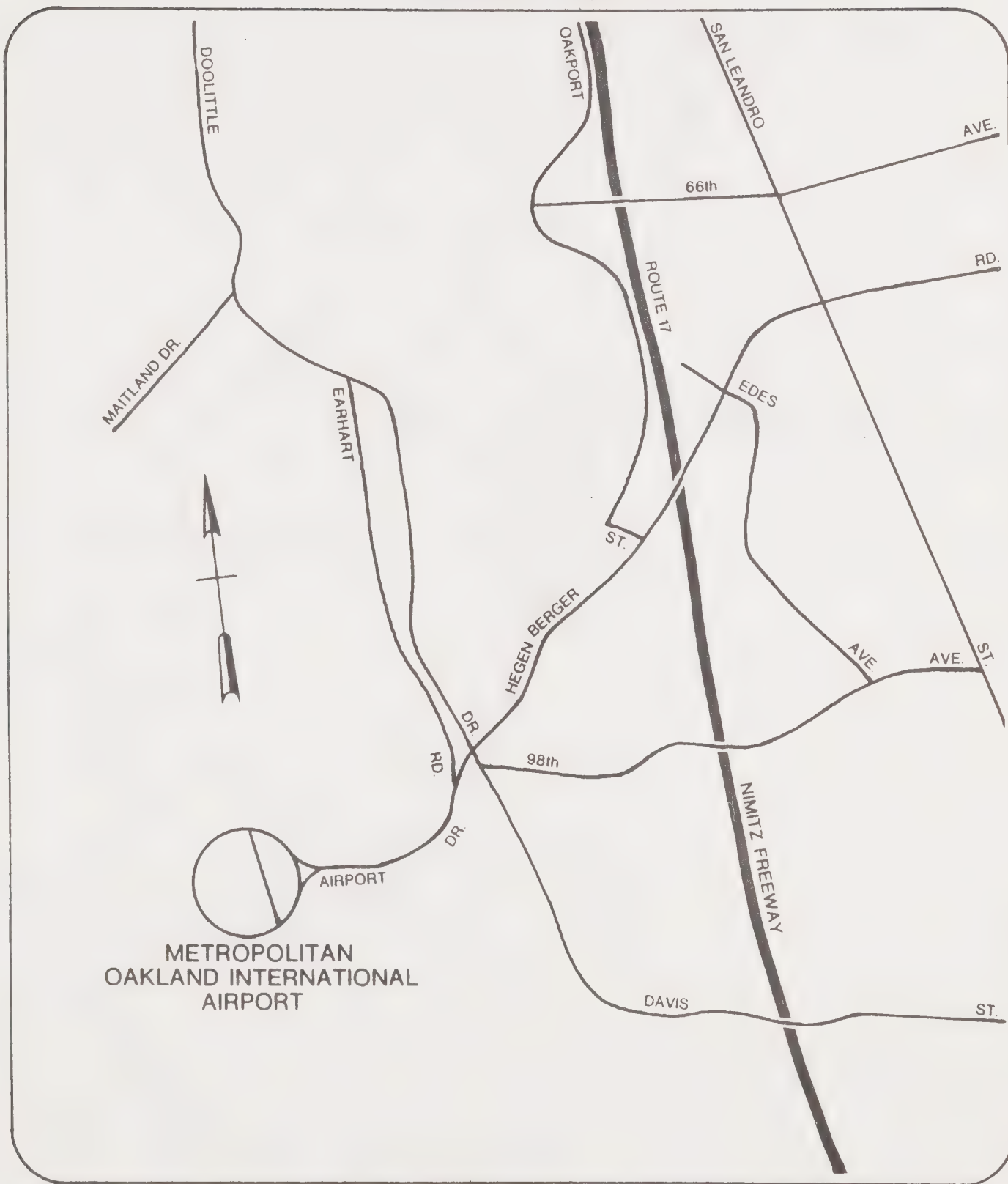
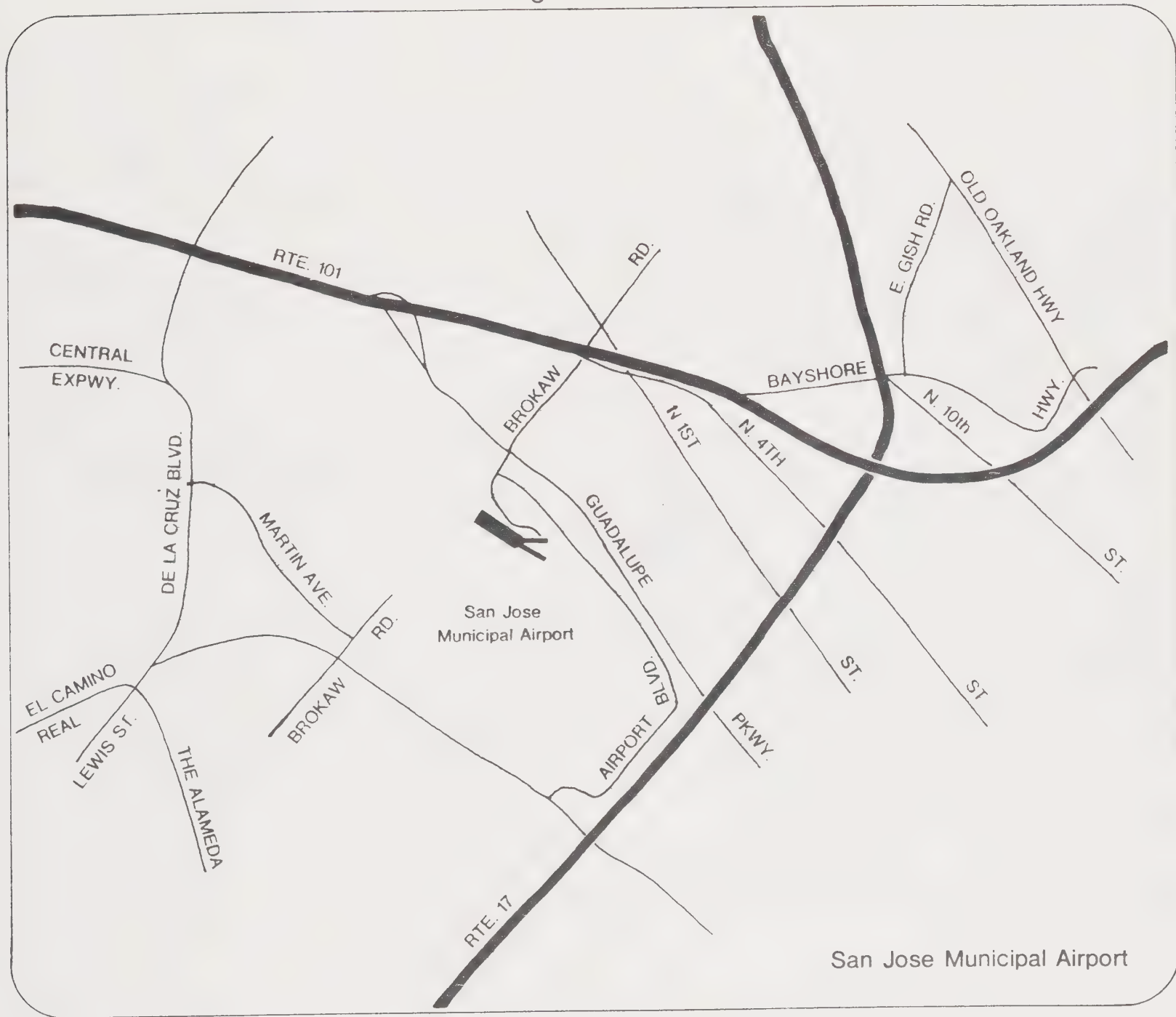


Figure VII-3



San Jose Municipal Airport

<u>Airport</u>	<u>Service</u>	<u>Area Served</u>	<u>Approximate 1977 Daily Patronage</u>
Oakland	AirBART	BART Coliseum Station	290
	AC Transit/ 57 Line	East Oakland	N/A
San Jose	Santa Clara County Transit/ 64 Line	Downtown San Jose	50

Existing Passenger and Employee Mode Split

About 60% of the region's air passengers use a personal car to get to the airport, while 29% use a taxi or rental car and 15% use public or private transit services. Over 75% of the airport employees use their personal cars and drive alone to work. Only 8% use public or private transit, and another 15% use carpools or vanpools. Individual mode choice patterns vary considerably by airports, as shown below.

ACCESS MODES USED TO AIRPORTS

(Percent of Passengers)

<u>Air Passengers</u>	<u>AIRPORT</u>		
	<u>San Francisco</u>	<u>Oakland</u>	<u>San Jose</u>
● Private Car	52.2%	79.7%	84.6%
● Rental Car	12.8	8.1	7.9
● Taxi	9.8	2.6	2.2
● Hotel Courtesy Car	3.7	2.3	1.6
● Transit	18.3	6.5	1.2
● Other	3.2	.8	2.5
Total	100.0%	100.0%	100.0%
<u>Employees</u>			
● Private Car	72.0%	88.5%	93.2%
● Carpools/Vanpools	16.6	6.9	3.7
● Transit	9.7	2.9	1.1
● Other	1.7	1.7	2.0
Total	100.0%	100.0%	100.0%

Congestion

As part of the regional study, Caltrans conducted "floating" car runs to measure current levels of congestion. At San Francisco Airport the opening of Route 380 in February, 1976 shifted an estimated 3,000 average daily trips from U.S. 101 south of San Francisco Airport to I-280 and I-380. Route 380 has also absorbed at least 4,000 average daily trips that previously used San Bruno Avenue. In 1977, congestion studies indicated that there were pockets of congestion in the northbound direction from Poplar-Dore Avenue to Millbrae Avenue south of the airport lasting from 7:15 a.m. to 8:15 a.m. Moderate afternoon congestion occurred southbound from 4:45 p.m. to 5:30 p.m. and extended from the airport to Peninsula Avenue.

At Oakland Airport, heavy northbound congestion exists between Jackson Street and Hesperian Boulevard from approximately 6:15 a.m. to 8:30 a.m. Heavy southbound congestion occurs from Marina Boulevard south to A Street and lasts from approximately 3:45 p.m. to 5:30 p.m. South of A Street the congestion is also heavy but limited to about 20 minutes.

At San Jose Airport extension of Route 280 through to Route 101 south of the San Jose Airport decreased traffic on Route 17 adjacent to San Jose Airport. However, major congestion still exists northbound on Route 17 and Route 101 in the morning and southbound in the evening.

C. APPROACH

The primary objective of the ground access analysis was to evaluate the ability of the airport ground access system to serve projected traffic through 1997. A computer model was used to forecast air passenger and employee traffic and assign this traffic to the most convenient airport access route. The model estimates airport traffic based on the location of air passenger and employee trips in the region, mode choice behavior, and number of persons per vehicle. Separate forecasts and access route assignments were developed for "other" airport traffic (traffic associated with air cargo, airport service and maintenance functions, general aviation, etc.). Various strategies were also evaluated for minimizing airport traffic.

Traffic Mitigation Measures

- 25% Transit Use. In accordance with regional policies, this strategy assumes that 25% of the air passengers and airport employees would use transit.
- 25% Carpool/Vanpool Use. This strategy assumes that 25% of the employees would be involved in ride-sharing.
- Reduced "Kiss-and-Fly." This strategy tests the impact of added long-term parking on passenger drop off and pick up traffic. ("Kiss-and-Fly" trips generate two vehicle trips for each air passenger arrival or departure.) The effect of this strategy on total parking requirements and transit development objectives needs to be carefully reviewed.
- Employee Shift Staggering. This strategy evaluates the potential for altering airport work shifts to avoid heavy concentrations of traffic during the peak freeway commute periods.

D. FINDINGS

Traffic Forecasts

Forecasted surface traffic at each airport is a function of the role of the airport in the regional system and the specific types of activity that take place at each airport. Important considerations in the traffic forecasts are the number of air passengers and airport employees and the amount of air cargo. Differences in the types of activity located at each airport have a major influence on surface traffic. For instance, San Francisco Airport and Oakland Airport have major airline maintenance facilities (United and World Airlines) while San Jose does not. Both Oakland and San Jose Airports have significant amounts of general aviation activity, while San Francisco Airport handles large amounts of air freight and air mail.

Tables VII-1 to VII-3 show how estimated airport traffic varies by activity level for passenger, employee, and "other" traffic. Traffic volumes were calculated based on existing mode choice patterns for air passengers and airport employees.

FORECASTS OF AVERAGE DAILY TRAFFIC

<u>Airport</u>	<u>Millions of Annual Passengers</u>	<u>Traffic</u>	<u>Percent Increase Over 1977 Traffic</u>
San Francisco	18.9*	96,000	-%
	27.0	110,260	14.9
	31.0	128,680	34.0
	35.0	142,910	48.9
	43.6	171,080	78.2
Oakland	2.5*	20,500	-
	4.2	26,230	28.0
	7.0	36,600	78.5
	8.0	39,890	94.6
	10.0	49,730	142.6
	13.0	62,050	202.7
San Jose	3.0*	21,850	-
	5.3	30,390	39.1
	7.0	37,840	73.2
	8.0	42,800	95.9
	10.0	50,220	129.8

Note: *1977 activity levels.

TABLE VII-1

SAN FRANCISCO AIRPORT TRAFFIC FORECASTS

(Average Daily Traffic)

<u>Year</u>	<u>Forecast Range</u>	<u>Alternative</u>	<u>MAP</u>	<u>Average Daily Vehicle Trips</u>			<u>Total</u>
				<u>Air Passengers</u>	<u>Airport Employees</u>	<u>Other</u>	
1977		Existing	18.9	41,340	28,270	27,200	96,800
1987	Low	1	28.8	53,790	33,040	33,880	120,710
		3a	24.0	40,790	30,050	31,970	102,810
	High	1	33.5	62,510	35,610	35,450	133,570
		2	31.0	55,560	34,060	34,420	124,040
		3a	27.6	46,880	32,620	33,190	112,690
		3b	27.0	45,420	31,650	33,190	110,260
		4a	28.7	53,790	33,040	33,880	120,710
1997	Low	1	35.0	67,210	34,710	40,990	142,910
		2	31.0	56,450	32,500	39,200	128,150
		3a	27.0	47,530	30,410	37,650	115,590
	High	1	43.6	83,630	38,670	48,780	171,080
		3a	32.2	54,700	33,240	43,350	131,290
		3b	31.0	53,240	32,090	43,350	128,680
		4a	33.0	58,620	33,060	44,120	135,800
		4b	31.0	56,460	31,980	44,120	132,560
		4c	34.0	62,920	33,890	45,000	141,810
		4d	33.0	60,370	33,060	43,930	137,360

Note: Ground access trips by flight crews were initially included in "Other" category but were forecasted as part of Airport Employee traffic.

Alternative 1 - Existing Airport Shares
 Alternative 2 - Airline Plan
 Alternative 3 - Regional Airport Plan
 Alternative 3b - Regional Airport Plan with North Bay
 Alternative 4 - San Jose Constrained

TABLE VII-2

OAKLAND AIRPORT TRAFFIC FORECASTS

(Average Daily Traffic)

<u>Year</u>	<u>Forecast Range</u>	<u>Alternative</u>	<u>MAP</u>	<u>Average Daily Vehicle Trips</u>			<u>Total</u>
				<u>Air Passengers</u>	<u>Airport Employees</u>	<u>Other</u>	
1977		Existing	2.5	9,200	6,240	5,060	20,500
1987	Low	1	3.6	11,750	6,660	5,420	23,830
		3a	7.0	21,330	8,400	6,870	36,600
	High	1	4.2	13,650	7,030	5,550	26,230
		2	6.7	20,790	8,270	6,620	35,680
		3a	8.4	25,160	9,410	7,240	41,810
		3b	8.0	23,650	9,000	7,240	39,890
		4a	8.0	23,650	9,000	7,240	39,890
1997	Low	1	4.4	14,390	7,640	5,840	27,780
		2	8.4	26,020	9,530	7,790	43,340
		3a	10.0	30,600	10,400	8,730	49,730
	High	1	5.5	17,910	8,290	6,270	32,470
		3a	13.8	40,210	12,700	10,980	63,890
		3b	13.0	39,140	11,930	10,980	62,050
		4a	13.0	38,450	11,930	10,630	61,010
		4b	15.0	42,480	12,930	11,780	67,190
		4c	10.0	30,600	10,400	9,000	50,000
		4d	15.0	43,640	12,930	11,440	68,010

Note: Ground access trips by flight crews were initially included in "Other" category but were forecasted as part of Airport Employee traffic.

Alternative 1 - Existing Airport Shares
 Alternative 2 - Airline Plan
 Alternative 3 - Regional Airport Plan
 Alternative 3b - Regional Airport Plan with North Bay
 Alternative 4 - San Jose Constrained

TABLE VII-3

SAN JOSE AIRPORT TRAFFIC FORECASTS

(Average Daily Traffic)

<u>Year</u>	<u>Forecast Range</u>	<u>Alternative</u>	<u>MAP</u>	<u>Average Daily Vehicle Trips</u>			<u>Total</u>
				<u>Air Passengers</u>	<u>Airport Employees</u>	<u>Other</u>	
1977		Existing	3.0	11,480	1,720	8,650	21,850
1987	Low	1	4.6	15,580	2,700	9,020	27,300
		3a	6.0	20,450	3,340	9,720	33,510
	High	1	5.3	18,000	3,000	9,390	30,390
		2	5.3	18,000	3,000	9,390	30,390
		3a	7.0	23,970	3,770	10,100	37,840
		3b	7.0	23,970	3,770	10,100	37,840
		4a	5.3	18,000	3,000	9,390	30,390
1997	Low	1	5.6	19,000	3,240	9,470	31,710
		2	5.6	19,000	3,650	9,880	32,530
		3a	8.0	26,690	4,310	10,910	41,910
	High	1	6.9	23,400	3,830	9,990	37,220
		3a	10.0	33,180	4,340	12,700	50,220
		3b	10.0	33,180	5,220	12,700	51,100
		4a	8.0	27,160	4,340	11,300	42,800
		4b	8.0	27,160	4,340	11,300	42,800
		4c	8.0	27,160	4,340	11,300	42,800
		4d	8.0	27,160	4,340	11,300	42,800

Note: Ground access trips by flight crews were initially included in "Other" category but were forecasted as part of Airport Employee traffic.

Alternative 1 - Existing Airport Shares
 Alternative 2 - Airline Plan
 Alternative 3 - Regional Airport Plan
 Alternative 3b - Regional Airport Plan with North Bay
 Alternative 4 - San Jose Constrained

Comparison of Traffic with Highway Capacity

The convergence of airport traffic from different areas on the highway segments adjacent to the airport creates the potential for major congestion affecting airport and non-airport traffic alike. As a starting point for evaluating future access conditions, it is important to determine how much capacity the airport will require on these critical highway segments independent of other traffic demands. A high use of capacity by an airport indicates the potential for major congestion, since it can be assumed that there will be some growth in non-airport traffic on the highways as well.

Two contrasting airport system alternatives were compared in order to evaluate traffic impacts. Alternative 1 maximizes traffic at San Francisco Airport and minimizes traffic at Oakland and San Jose Airports. Alternative 3b maximizes traffic at Oakland and San Jose Airports and minimizes traffic at San Francisco Airport. (See Table VII-4)

Growth in activity at San Francisco Airport would contribute to congestion on Route 101 south of the Airport (Alternative 1). Shifting traffic to other Bay Area airports (Alternative 3b) would result in a reduction in airport traffic on this and other segments of Route 101. Except under Alternative 3b in 1997, Oakland Airport would not require a significant amount of freeway capacity. At San Jose Airport, traffic is distributed over a number of access routes, and no single facility is required to carry a major portion of the surface traffic. As noted earlier, however, San Jose freeways are congested during peak hours so that traffic destined for the airport would continue to experience moderate to major delays during peak commute hours.

Future Congestion

Congestion usually occurs due to excessive demand on local streets and highways. The magnitude of future highway congestion can be inferred from the demand/capacity ratio calculated for a specific set of conditions. However, there are inherent difficulties in this approach. First, the magnitude of the congestion will vary by time of day, access route, direction of travel, day of the week, etc. The proportion of airport trips that will be severely affected is therefore difficult to estimate.

A more fundamental problem, however, has to do with the dynamics of the transportation system. For example, travel projections may show that in ten years traffic on certain highway segments will substantially exceed the existing capacity. It is necessary to ask, Is this realistic? Probably not. While these projections are indicative of continuing and perhaps increasing congestion, it is likely that a substantial number of people would shift to other modes of transportation, use alternative routes, adjust their time of travel, or cancel their trip. That is, "demand" will adjust itself to the available "capacity". It is also recognized that the future cost and supply of energy for automobiles will have a major impact on freeway traffic growth.

TABLE VII-4

PERCENT OF FREEWAY CAPACITY USED BY AIRPORT

(Average Day of Peak Month)

<u>Airport</u>	<u>Access Route/Location</u>	<u>No. of Lanes</u>	<u>Alternative 1 1987</u>	<u>Alternative 1 1997</u>	<u>Alternative 3b 1987</u>	<u>Alternative 3b 1997</u>
San Francisco	101 - North of Rte. 380 Jct.	8	29%	41%	23%	26%
	101 - South of Broadway	8	30	38	23	27
	380 - West of Airport	8	26	34	22	27
Oakland	17 - North of Hegenberger	8	10	13	17	28
	17 - South of Davis Street	8	4	5	7	9
San Jose	17 - South of Coleman	6	7	8	9	11
	17 - North of Brokaw	6	6	5	6	7
	101 - North of Guadalupe	6	4	5	5	6
	101 - South of Rte. 17 Jct.	6	9	12	11	17

Note: Based on existing passenger and employee mode choice behavior. Assumes capacity of an eight lane freeway is approximately 160,000 vehicles per day and capacity of a six lane freeway is approximately 120,000 vehicles per day.

With the exception of San Jose Airport, major urban congestion does not presently occur adjacent to the airports. Analyses performed for this study, however, indicate that growth in airport and non-airport traffic will probably cause congestion to occur adjacent to San Francisco and Oakland Airports in future years.

Peak urban commute hours, while not necessarily the peak airport traffic hours, will present the most difficult time to get to and from the airports. Morning peak hour conditions (7:30-8:30 a.m.) were analyzed in some detail with the following results:

- San Francisco Airport - A.M. Peak Hour Conditions

101 - North of Route 380 (Southbound)	No congestion through 1997
101 - South of Millbrae Avenue (Northbound)	Major congestion through 1997
380 - West of Airport (Eastbound)	No congestion through 1997

- Oakland Airport - A.M. Peak Hour Conditions

17 - South of Airport (Northbound)	Major congestion through 1997
17 - North of Airport (Southbound)	Moderate congestion after 1987

- San Jose Airport - A.M. Peak Hour Conditions

101 - North of Guadalupe (Southbound)	Moderate congestion after 1987
101 - South of Route 17 (Northbound)	Major congestion through 1997
17 - North of Brokaw (Southbound)	Moderate congestion after 1987
17 - South of Coleman (Northbound)	Minor congestion through 1997

Effectiveness of Traffic Mitigation Measures

The effectiveness of each of the traffic mitigation measures was estimated and is measured as the percentage reduction in total airport traffic--passenger, employee, and "other" traffic. The results shown below are relative to existing conditions (e.g., current auto and transit use patterns).

EFFECTIVENESS OF TRAFFIC MITIGATION MEASURES

(Percent Reduction in Total Airport Traffic)

<u>Mitigation Strategy</u>	<u>Groups Affected</u>	<u>AIRPORT</u>		
		<u>San Francisco</u>	<u>Oakland</u>	<u>San Jose</u>
● 25% Transit Use	All			
	Passengers & Employees	6.0- 9.0%	14.3-17.2%	15.6-17.9%
● 25% Carpool/ Vanpool Use	Employees	1.2- 1.5%	2.3- 3.1%	1.2- 1.4%
● Reduced "Kiss-&-Fly"	Resident Passengers	<u>1.6- 2.0%</u>	<u>4.3- 4.8%</u>	<u>4.1-4.5%</u>
● Cumulative Reduction		9.1-12.3%	21.7-24.7%	21.0-23.6%

Note: Numbers will not add vertically because effectiveness varies according to airport system alternative.

- **Employee Shift Staggering.** Airport employee shifts are already staggered to the extent that operation of an airport is a 24-hour activity that typically involves at least three major shifts. At San Francisco Airport, only 22% of the work force arrives between 7-8 a.m. At Oakland and San Jose Airports, concentration of employees in the 8-5 daytime shift is in much greater evidence and consequently such a strategy would be more effective at these airports as traffic increases.

Potential Transit Markets

Very high airport trip densities (trips/acre) are estimated for the downtown San Francisco hotel area and Central Business District. These densities are over 100 times larger than the maximum passenger and employee trip densities estimated for Oakland and San Jose Airports. Because of the high trip densities in San Francisco, frequent express bus service can be provided to the San Francisco Airport. The projected

magnitude of airport trip densities in San Mateo County suggests that a fixed route bus system with some airport express service would be the optimum service pattern. Some express service could also be extended into Santa Clara and Southern Alameda counties. A mixture of local and express service could also be used at Oakland and San Jose Airports. Although airport trip densities decrease with distance from San Francisco Airport, effective coordination of regional transit services could attract a high proportion of travelers from Alameda, Contra Costa, Marin, and Santa Clara Counties to transit. There also appears to be a growing market for smaller private services that would connect the remote parts of the Bay Area which have relatively low trip densities to each airport.

E. PROPOSALS

Preparation of Transportation Development Programs

Airport master plans rarely focus on the more complex aspects of a comprehensive transportation development program. MTC Resolution 592 expresses the Commission's interest in the preparation of a coordinated transportation development program at each airport. Resolution 592 makes the preparation of such programs a condition for favorable review and approval of major airport expansion programs involving State or Federal aid. Elements of such a program that are of specific interest to the Commission include:

- **Transit Coordination and Leadership.** Evidence the airport has taken a leadership role in developing improved transit.
- **Transit Ridership Goals.** These goals shall be developed in cooperation with the airport transit operators. Airport operators will be given flexibility in determining transit goals consistent with the magnitude of the proposed expansion program, service area characteristics, and transit operator constraints. Programs should specifically address the feasibility of providing service at a level sufficient to accommodate 25% of the air passenger and airport employee trips by transit.
- **Preferential Treatment of Transit on the Airport.** Plans to improve the movement of transit vehicles through the airport and facilitate loading and unloading of passengers.
- **Transit Information.** Programs to expand and improve the dissemination of transit information.
- **Ride-Sharing.** Airport actions to coordinate and promote ride-sharing among airport employees.
- **Paratransit.** Programs to increase the use and effectiveness of taxis and hotel/motel courtesy cars.
- **Transportation System Monitoring.** Establishment of a coordinated program to monitor airport transit ridership and surface traffic at appropriate intervals.

Lead Agency: Airport Operator

Supporting

Agencies: MTC, Caltrans

Action: Airport Operator - Budget resources to prepare transportation development program

MTC - Assist airport operator in preparing transportation development program. Assist in the coordination with transit operators and local jurisdictions. Provide up-to-date airport access information through passenger and employee surveys.

Time Frame: Transportation development programs shall be prepared in advance of major funding requests submitted as part of an ongoing airport expansion program

San Francisco Airport

- **I-380/Main Airport Interchange Project.** The analysis of future peak hour traffic indicates that there will be major congestion on Route 101 south of the airport. Faced with this congestion, it is possible that an increasing portion of airport traffic from the south will use I-280 and I-380 to access the airport. This traffic--combined with other traffic from the north--could overload the single auxiliary lane between I-380 and the main airport interchange. Construction of an additional auxiliary lane from I-380 and to the Airport and reconstruction of the main airport interchange is currently programmed in the 5-year Regional Transportation Improvement Program. However, regional policy also emphasizes the need to reduce the reliance on the personal automobile to get to the airport. Hence, it is proposed that the Airport review the project with Caltrans and other agencies to make sure that a) the design does not foreclose any options to develop preferential facilities for transit/high occupancy vehicles, and b) the project represents the best transportation improvement program on the airport for the amount of money available. If other projects appear to be more beneficial--such as projects that could significantly improve transit access--it would be possible to initiate a transfer of funds from the I-380 interstate project to a substitute group of projects. This possibility should be seriously explored.

Lead Agency: Airport

Supporting

Agency: MTC, Caltrans

Action: Review plans for I-380 auxiliary lane and main airport interchange improvements. Suggest methods to improve access to airport by transit and high occupancy vehicles. Initiate a transfer of interstate funds for substitute projects if appropriate.

Time Frame: Short Range

- **Coordination of Existing Regional Transit Services.** Improved bus service from Daly City or another downtown BART station to the Airport would greatly benefit East Bay passengers using the San Francisco Airport. Existing downtown airport transit services could be rerouted to serve BART on their way to the Airport or a shuttle bus could be initiated between the BART Daly City Station and the Airport providing express airport service. The magnitude of congestion south of the Airport also points to the increased attractiveness of the Southern Pacific Commuter rail service as an airport access mode. (Upgraded SP service is recommended in the Regional Transportation Plan as a short range improvement for the West Bay Corridor.) A shuttle bus linking SP's Millbrae Station and the airport should be considered. As airport activity increases, consideration should also be given to the feasibility of relocating the SP station to the West of Bayshore property adjacent to the Airport. San Francisco Airport should consider subsidizing a portion of the future operating costs of these services. Changes in the City Charter may be required to enable this subsidy.

Lead Agency: SamTrans, BART, Private Operators

Supporting

Agency: San Francisco Airport

Action: Consider improved connection between BART/SP and the Airport.

Time Frame: Short Range

- **Expanded Area Bus Service.** As airport activity increases, the following measures should be cooperatively explored by the local transit operators (SamTrans, Airporter, Greyhound, and other private operators) and the airport: a) extended area coverage for airport services, b) increased express bus service during peak airport activity periods, c) implementation of remote off-airport Park-and-Ride facilities with sufficient space for short term parking and drop off/pick up activity, and d) coordination with local jurisdictions to establish preferential access routes to the airport. Direct bus service from Santa Clara County to the San Francisco Airport should be provided if possible. Detailed passenger and employee origin/destination information is available from MTC and can be used by the transit operators in reviewing potential patronage levels for new services.

Lead Agency: Transit Operators

Supporting

Agency: MTC

Action: Transit Operators - Monitor airport transit ridership and assess operational and financial feasibility of staged improvements outlined above.

MTC - Consider support of improved airport services through allocation of transportation assistance funds

Time Frame: Variable

- **Private Transit Services from Remote Areas.** Private transit service from the North Bay and other remote areas should be encouraged. In most cases private operators can provide superior service to that provided by public operators since the private services do not require an intermediate transfer (often with baggage). Airport fees should not constitute a hardship for smaller transit operators providing this service.

Lead Agency: Airport

Action: Periodically review fee structure with smaller private operators to determine impact on their financial conditions.

Time Frame: Variable

- **Expanded Taxi Group Rides.** Groups of passengers riding taxis should be able to split the taxi fare to common destinations. The availability of group rides will lower the cost to the individual, increase the use of taxis, and reduce the drop off/pick up traffic at the airport curbside.

Lead Agency: Taxi Industry

Action: Encourage passengers to ride in groups

Time Frame: Short Range

- **BART Extension from Daly City to San Francisco Airport.** Extension of BART from Daly City to the Airport is included in the Regional Transportation Plan as a long range proposal for the West Bay Corridor. Difficult financial and institutional problems need to be resolved. A BART extension would have significantly more capacity than would be required for the airport alone; however, such an extension may provide an overall improvement in the regional transportation system. Future regional air travel surveys should develop airport access information in sufficient detail to address this issue. Airport plans for the West of Bayshore property should preserve the option for a BART station at this location, since existing plans for a subway beneath the parking garage may prove to be too costly.

Lead Agency: BART
Supporting Agency: MTC
Action: MTC - Assist in evaluating institutional and financial issues related to BART extension. Provide data through airport surveys that can be used to assess future BART patronage to the Airport.
Time Frame: Short Range

Oakland Airport

- **Local Street Access.** The San Leandro Bay Transportation Study, a cooperative effort by ten public agencies to resolve transportation problems in the area surrounding San Leandro Bay, analyzed future traffic associated with the Airport, Bay Farm Island development, the Port of Oakland Cargo Distribution Center and the Port of Oakland Industrial Park. The study raised serious questions about the capability of Hegenberger Road and other streets and intersections around the airport to serve future airport and non-airport traffic. Hegenberger Road will be most critically impacted since it is projected to handle over 65% of the traffic into and out of the airport. Doolittle Drive will also be saturated by 1987 both north and south of the airport. Improved access to the Industrial Park from 66th Avenue should be considered as a means to relieve Hegenberger Road. Upgrading 98th Avenue or constructing a Davis Street extension would facilitate access to the airport and Bay Farm Island from the south.

Lead Agency: City of Oakland, Port of Oakland
Action: Evaluate potential improvements for Hegenberger Road that would remove existing constraints and increase capacity. Major improvements should be identified and included in the Regional Transportation Improvement Program (TIP).
Time Frame: Medium Range

- **Extension of Hegenberger Expressway to I-580.** This project is listed in the Oakland Airport Master Plan as a possible airport access improvement and has potential benefits for access to the Coliseum Complex and the Eastmont shopping center as well. In terms of airport access, upgrading Edwards Avenue to the Hegenberger Expressway would remove an existing constraint for traffic travelling to the Airport on I-580. Existing neighborhoods and schools in the area as well as the difficult geometry associated with an interchange at I-580 are major problems with respect to route alignment and construction costs.

Lead Agency: City of Oakland

Supporting

Agency: Caltrans

Action: Further define feasibility and costs of the proposed extension.

MTC Role: Review status of project as part of annual TIP process.

Time Frame: Medium Range

- **BART Connection to Oakland Airport.** Studies have been conducted by the Port of Oakland involving the design of an automated Connector System operating on its own right-of-way between the BART Coliseum Station and the Oakland Airport. MTC has indicated that this project would be reviewed again before any further funding commitment is made. The source of funds used to construct the project will be a key factor in its ultimate success. An efficient transit connection between BART and the airport, just 3 miles away, has the potential to enhance the image of Oakland Airport as a regional airport facility, increase the potential for using transit to the Airport from all parts of the BART service area, and (in the absence of major improvements to Hegenberger Road) circumvent congestion between Route 17 and the airport. Because of the uncertainty concerning the future availability of capital funds the use of high capacity buses on local streets and preferential bus lanes should also be explored.

Lead Agency: Port of Oakland

Action: MTC Role: MTC must also consider the impact of funding the Connector System on other transportation projects in the region. If the Connector System uses traditional funding sources, this project would compete with other projects in the region.

Time Frame: Medium Range

- **Expanded Bus Service** (see San Francisco Airport).

San Jose Airport

- **Santa Clara Valley Corridor Evaluation (SCVCE).** The Metropolitan Transportation Commission and the Association of Bay Area Governments have conducted a major study to develop long range transportation and land use policies in Santa Clara County. As a result of this process, priorities have been established for future highway and transit improvements in this area.

Recommended highway improvements include widening Route 17 (6 lanes from Fremont to Route 101), Route 280 (8 lanes from Magdalena Road to Route 17), and Route 101 (6 lanes in vicinity of Alum Rock interchange) and constructing additional auxiliary lanes on Route 101 (north of Route 17). Transit recommendations include significant expansion of the bus fleet in order to provide increased express service and the possible development of a "light rail" line in the Guadalupe Corridor.

All of these recommendations would improve access to San Jose Airport to some extent. However, peak hour congestion will probably continue to exist on the freeways surrounding the airport and will present problems for which there is no easy solution. The evaluation of a county light rail system will consider extending the system through or near the Airport; however, only a portion of the San Jose Airport passengers and employees would be located in the light rail system's service area.

Lead Agency: Santa Clara County Transportation Agency

Supporting

Agency: MTC

Action: Conduct detailed alternatives analysis in Guadalupe Corridor for light rail and other transit technologies.

Time Frame: Short Range

- **Freeway Interchange Improvements.** The San Jose Airport Master Plan recommends improving the interchange between Guadalupe Parkway and Brokaw Road at the airport entrance and constructing a partial interchange between Guadalupe Parkway and Route 17. Regional studies, however, indicate a growing demand from the southern portions of Alameda and Santa Clara County, which suggests that other interchange improvements may be more important. These include completion of the Guadalupe interchange at Route 101 for access to/from the south on Route 101 or reconstruction of the N. 1st Street interchange (in conjunction with extension of Brokaw Road beneath Route 101 to the airport). Such improvements must compete with projects that already have high priorities as a result of the SCVCE. Caltrans, MTC, and the City of San Jose should cooperate in evaluating the feasibility and costs of these interchange improvements so that they may be considered in future programming decisions.

Lead Agency: City of San Jose

Supporting

Agency: MTC, Caltrans

Action: Determine feasibility and costs of improved interchanges

Time Frame: Short Range

- **Expanded Bus Service.** Improved bus service will be particularly important at San Jose Airport, which currently has the lowest transit use of the three airports. Local service should be improved as the County bus fleet is expanded. Express airport service from designated Park-and-Ride zones should be developed where possible.

Lead Agency: Santa Clara County Transportation Agency

Supporting

Agency: San Jose Airport

Action: Study potential for expanded express bus service in conjunction with designated remote Park-and-Ride lots.

Time Frame: As part of Airport's Transportation Development Program

Financing Airport Access Improvements

Rapid inflation and dwindling local government revenues will make it increasingly difficult to finance ground transportation improvements. It may become necessary to finance future airport access improvements from the Federal Aviation Trust Fund. This would mean changing current limitations on eligible projects which exclude many access-related projects. Further, the airports themselves may be required to subsidize "essential" transportation services. New mechanisms may have to be found to generate airport revenues specifically for the purpose of supporting these transit services.

Lead Agency: Airports

Supporting

Agency: MTC

Action: Support changes in airport funding legislation to increase availability of funds for airport access improvements constructed off the airport property. Identify "essential" transit services and evaluate existing and future need for airport subsidies.

Time Frame: Short Range

VIII. AIRPORT NOISE IMPACTS

A. ISSUES AND PROBLEMS

Noise has become a critical issue at practically all major airports, and particularly at airports where future expansion plans are being debated. Jet aircraft noise affects daily those living and working around airports: it affects some people's sleep and it interferes with normal conversation. A two-year study of jet noise around Los Angeles Airport found that the mortality rate in the airport area was 19% higher than a control area removed from airport noise (Note 1). Other studies have linked airport noise to birth defects (Note 2). While these studies are not necessarily conclusive, they do point to the reason for concern--noise can have measurable adverse physical and psychological effects on people who are sensitive to noise and who live around airports. Increasing numbers of airline flights under the Airline Deregulation Act have added a new dimension to the noise problem.

As a result of this concern over airport noise, the airlines are faced with expensive and complex noise control requirements. The airports, on the other hand, must contend with constant complaints and/or litigation involving their residential neighbors. Airports may also be obliged to initiate residential land acquisition programs, purchase noise easements or soundproof, homes and schools, which may ultimately have enormous costs.

Airport noise control actions in the Bay Area have taken a number of forms. Both San Francisco and San Jose Airports have prepared airport noise control and land use compatibility plans. These plans define on-airport controls as well as identify remedial programs for land uses off the airport. In addition the San Francisco Airport has previously initiated a variety of noise assessment and control measures including the preferential runway system, the visual shoreline departure, the visual bridge approach (over the San Mateo Bridge), restrictions on late night engine runups, installation of a noise monitoring system, and formulation of a noise abatement committee. San Jose Airport has acted to control noise through use of a higher glide slope for landings, contractual agreements with the airlines that permit limits on airport operating hours, a curfew after 12 midnight, a \$50 million land acquisition program, and installation of the Bay Area's first noise monitoring system. Oakland Airport's noise control program has included the purchase of a noise easement over portions of Bay Farm Island, requirements for business jets to use the main South Airport runway, and implementation of the "Silent 1" departure flight track to direct late night flights away from Alameda and Bay Farm Island.

Airport noise is regulated by the State, which has determined the maximum noise levels that will be permitted in residential communities surrounding the airports. The California Airport Noise Standards call for a phased reduction in airport noise over time such that the maximum level will not exceed 65 CNEL (Community Noise Equivalent Level) in residential areas in 1986.

In 1976 there were approximately 41,500 persons living in areas exposed to noise of 65 CNEL or greater. About 85% of these people were located in the noise impact area around San Francisco Airport. Although a large proportion of San Francisco flights take off and land over water, those that are not able to do so because of prevailing wind conditions affect a densely populated area that includes a large number of schools.

Regional actions to control and abate noise have focussed on the following areas:

1. Support Federal legislation to expedite and ensure the retrofit, re-engining, and replacement of older, noisier aircraft.
2. Encourage a redistribution of flights among Bay Area airports to reduce regional noise exposure.
3. Encourage the development of airport noise abatement programs.
4. Review land use decisions affecting compatible land uses around airports.
5. Support legislation to provide more effective local land use planning.

Probably the most effective mitigation measure is to control aircraft noise at the source, the aircraft engine. While compliance with the Federal schedule for retrofitting, re-engining, or replacing aircraft that do not meet Federal Aviation Regulation Part 36 aircraft noise certification standards is required by Federal law (FAR Part 91 Subpart E), less than 30% of the airlines in the U.S. fleet currently meet these standards.

Regional noise exposure can also be minimized by shifting some of the Bay Area traffic to other airports where the population impacted per daily flight is lower. Alternatives to San Francisco Airport include Oakland, with its overwater approaches and departures, San Jose, and a possible airport in the North Bay. All four of the potential North Bay Airport sites are located in relatively non-urbanized portions of the Bay Area and therefore do not have extensive land use compatibility problems at present.

As a condition for the favorable review of major applications for Federal airport development funds, ABAG and MTC have requested that each airport have a noise abatement program. These programs can address a range of options such as runway use changes, various limits on aircraft activity, limits on aircraft noise levels, pricing schemes, etc. Such programs will be reviewed by the FAA and CAB to determine whether any aspects of the programs are unduly discriminatory or constitute a burden on interstate commerce.

Preventing future increases in incompatible land uses around airports is also a key element in a successful regional noise control program. Land use controls off the airport are often difficult to implement, as they often involve several jurisdictions with conflicting interests. The most significant airport land use issue in the Bay Area in recent times centered around the Bay Farm Island development adjacent to the Oakland Airport. (A settlement agreement was eventually reached whereby portions of the development are now subject to a noise easement.) Other land use compatibility issues have appeared around Hamilton AFB and Travis AFB. While prevention of new incompatible land uses is difficult, correction of existing incompatible uses is even more difficult. Some suggestions for dealing with existing incompatible uses have been made in the form of revised Airport Land Use Commission (ALUC) legislation and in the San Francisco and San Jose Airport land use compatibility studies mentioned earlier.

The regional noise study therefore analyzes future noise impacts and proposes alternative regional strategies for a comprehensive noise control program. The intent of these strategies is to allow maximum flexibility at the local level to establish specific programs while providing overall regional guidelines for noise mitigation.

1. Effects of Jet Noise on Mortality Rates, W.C. Meecham and Neil Shaw, University of California at Los Angeles, 1978.
2. "Airport Birth Defects," Archives of Environmental Health, Noel Jones, University of California, March, 1978.

B. APPROACH

The Noise Model

A predictive noise model was used to estimate future airport noise levels associated with each airport system alternative. The predictive noise model employed by the Parry Company was first calibrated to ensure that the single event noise levels for each aircraft type were in the proper relation to each other and that the weighted sum of the single event levels matched the average daily Community Noise Equivalent Level (CNEL) measured by the airport noise monitors. The noise model was calibrated for San Francisco and Oakland Airports. (A similar model and calibration procedure was used at San Jose Airport as part of a separate and concurrent airport planning study.)

The noise model used in the study was originally developed at the Transportation System Center of the U.S. Department of Transportation. A set of 27 different aircraft types are included in the program but any number or type can be accommodated as necessary. Noise data for these 27 types were derived from FAA-sponsored aircraft noise definition studies, the open technical literature and Parry field measurements. The model also incorporates special factors to account for fuselage or wing shielding of engines and for excess ground attenuation. The input data for the program includes a description by aircraft type of flight paths, takeoff and landing profiles and aircraft performance in terms of speeds and engine thrusts. Also, a calibration factor is provided by aircraft type and flight segment to effect an agreement with measured aircraft noise levels. The calibration factor inherently accounts for altitude, terrain and operational details that may be unique to any particular airport.

The Metropolitan Transportation Commission and its consultant, Aviation Planning Services, provided all aircraft operations data used in the model calibration. This data was verified with the Federal Aviation Administration and the airport operators.

Assumptions

The regional airport noise analysis was based on a number of assumptions; these assumptions are important and should be kept in mind when reviewing subsequent tables.

- **San Francisco Airport** - The noise forecasts prepared for San Francisco Airport assume a complete retrofit, re-engining or replacement of all non-Part 36 aircraft using the airport by 1987. The percentage use of the various flight tracks remains essentially the same as present day; however, projected changes in the traffic growth to different city destinations will change the overall flight track utilization somewhat. The existing distribution of aircraft landings and takeoffs among the day, evening, and night time periods was also retained for the purpose of the regional analysis.

(Limitations on the number and type of aircraft operating in the late evening are discussed further on.) In order to provide a clearer reference point for land use impact comparisons, the basic demographic characteristics of San Mateo and southern San Francisco County were held constant throughout the forecast period (1970 Census Data Base).

- **Oakland Airport** - Like San Francisco Airport, it has been assumed that all aircraft operating at Oakland Airport in 1987 and beyond meet the most stringent Federal aircraft noise control standards. About 80% of the late night operations at Oakland have been assigned to the "Silent 1" flight track to shift departures away from sensitive, populated areas on Alameda and Bay Farm Islands. The day, evening, and night distribution of aircraft landings and takeoffs reflects the change in airport service pattern anticipated in the regional plan. To estimate future noise exposure on Bay Farm Island, a complete buildout of the remaining portions of the development has been assumed. Portions of Alameda Island near the Naval Air Station are also impacted in 1987 and 1997.
- **San Jose Airport** - Aircraft operating at San Jose Airport in 1987 and 1997 are also assumed to meet the Federally required compliance schedule for quieting and replacing non-Part 36 aircraft. Flight track utilization is based on the performance of the aircraft and ultimate airport destination. Existing aircraft operating procedures to minimize noise over San Jose and Santa Clara are used throughout the forecast period. It is further assumed that San Jose will control late night operations, essentially limiting takeoffs and landings during this period to 5% or less of total daily operations (the equivalent level is about 13-14% at San Francisco and Oakland). Estimated airport noise impacts are based on the conversion of 117 acres of land south of the airport to airport-compatible uses by 1987. Other vicinity area land uses are held constant throughout the forecast period.
- **North Bay Airport** - Potential North Bay airport sites include Hamilton AFB, Sonoma County Airport, Napa County Airport, and Travis AFB. The flight track assumptions and day, evening, night operations distribution are based on past reports and discussions with air traffic control personnel. Noise contours were prepared using identical assumptions at all three airports with respect to daily operations and aircraft types serving the airports. Airport noise contours for Hamilton, Sonoma County, and Napa County represent only the noise produced by airline operations and do not include any contribution from general aviation aircraft activity. The noise contours prepared for Travis AFB are representative of the combined level of civilian and military operations that would occur at the airport in future years.

C. FINDINGS

General

Future airport noise levels are regulated by the State of California under the Airport Noise Standards. Specifically, the State has established the following limitations on airport noise in residential communities (measured in Community Noise Equivalent Levels or CNEL):

75 CNEL by January 1, 1976

70 CNEL by January 1, 1981

65 CNEL by January 1, 1986

Projected regional noise impacts in 1987 and 1997 are referenced to the 65 CNEL standard effective January 1, 1986.

Projected Regional Noise Trends

Table VIII-1 shows that the high passenger forecast for the region will produce a worsening noise situation. Although aircraft will be larger and quieter, changes in the airline fleet mix and aircraft technology will not be enough to compensate for the growth in passenger traffic and the development of new incompatible land uses around some airports.

In 1976 there were approximately 41,500 persons living in areas exposed to noise of 65 CNEL or greater. Under the high passenger forecast, the number of persons living in these areas would increase to 56,000 to 61,000 in 1987 but decrease to 45,000 to 57,000 by 1997. (Between 3000 and 5000 persons in this total would be living in newly constructed homes around Oakland Airport.) These results illustrate the extremely difficult task of complying with the State Airport Noise Standards and suggest that as a practical matter more modest goals for noise abatement must be set that recognize some level of residual noise in residential areas.

Tables VIII-2 and Table VIII-3 show the noise forecasts for each airport in 1987 and 1997. These tables illustrate the significant variation in noise exposure that would be produced by different airport activity assumptions. A substantial increase in future noise impacts was estimated for Oakland and San Jose Airports. At Oakland these increases can be attributed to the buildout of Bay Farm Island and the extension of the noise contours into northern portions of Alameda Island in 1987. Existing residential areas on Bay Farm Island will also be impacted. If a larger share of Bay Area traffic is allocated to Oakland Airport in 1987 and 1997, the 65 CNEL Contour will extend beyond the noise easement on Bay Farm Island. At San Jose Airport the noise forecasts primarily reflect the extension of the contours into the densely developed area south of the airport.

TABLE VIII-1
PROJECTED REGIONAL AIRPORT NOISE TRENDS

(Population and Dwelling Units Within 65 CNEL Contour)

<u>YEAR</u>	<u>FORECAST RANGE</u>	<u>ALTERNATIVE</u>	<u>POPULATION</u>	<u>DWELLING UNITS</u>	
1977		Existing	41,500	14,110	
1987	Low	1	46,640	16,510	
		3a	45,640	16,480	
	High	1	61,400	21,510	
		2	57,720	20,140	
		3a	57,860	20,960	
		3b*	55,940	20,370	
		4a*	56,800	20,440	
	1997	Low	1	43,400	14,980
			2	39,700	13,750
3a			37,890	13,270	
High		1	56,620	19,430	
		3a	46,820	16,410	
		3b*	45,180	15,920	
		4a*	46,340	16,410	
		4b*	45,040	15,940	
		4c*	47,890	16,580	
		4d	47,480	16,620	

*Assumes zero noise impacts from North Bay operations.

Alternative 1 - Existing Airport Shares
 Alternative 2 - Airline Plan
 Alternative 3 - Regional Airport Plan
 Alternative 3b - Regional Airport Plan with North Bay
 Alternative 4 - San Jose Constrained

TABLE VIII-2

PROJECTED REGIONAL NOISE TRENDS BY AIRPORT

- Population Exposed to 65 CNEL or Greater -

<u>YEAR</u>	<u>FORECAST RANGE</u>	<u>ALTERNATIVE</u>	<u>SFO</u>	<u>AIRPORT</u>		<u>TOTAL</u>
				<u>OAK</u>	<u>SJC</u>	
1976		Existing	35,080	240	6,200	41,520
1987	Low	1	28,670	5,110	12,860	46,640
		3a	19,910	9,350	16,380	45,640
	High	1	41,460	5,530	14,410	61,400
		2	34,910	8,400	14,410	57,720
		3a	25,480	13,720	18,660	57,860
		3b	23,560	13,720	18,660	55,940
		4a	28,670	13,720	14,410	56,800
1997	Low	1	34,640	3,780	4,980	43,400
		2	28,240	6,480	4,980	39,700
		3a	22,470	7,270	8,150	37,890
	High	1	45,440	4,450	6,730	56,620
		3a	28,620	8,850	9,350	46,820
		3b	27,090	8,740	9,350	45,180
		4a	29,450	8,740	8,150	46,340
		4b	27,090	9,800	8,150	45,040
		4c	32,470	7,270	8,150	47,890
		4d	29,450	9,800	8,150	47,480

Alternative 1 - Existing Airport Shares
 Alternative 2 - Airline Plan
 Alternative 3 - Regional Airport Plan
 Alternative 3b - Regional Airport Plan with North Bay
 Alternative 4 - San Jose Constrained

TABLE VIII-3

PROJECTED REGIONAL NOISE TRENDS BY AIRPORT

- Number of Dwelling Units, Schools and Hospitals
Exposed to 65 CNEL or Greater -

YEAR	FORECAST RANGE	ALTERNATIVE	ITEM	AIRPORT			TOTAL
				SFO	OAK	SJC	
1976		Existing	DU S&H	12,400 14	80 -	1,630 5	14,110 19
1987	Low	1	DU S&H	10,250 15	1,980 -	4,280 8	16,510 23
			DU S&H	7,300 9	3,610 1	5,570 8	16,480 18
		3a	DU S&H	14,530 16	2,130 -	4,850 8	21,510 24
			DU S&H	12,240 15	3,050 2	4,850 8	20,140 25
	High	2	DU S&H	9,220 10	5,340 3	6,400 9	20,960 22
			DU S&H	8,630 10	5,340 3	6,400 9	20,370 22
		3a	DU S&H	10,250 15	5,340 3	4,850 8	20,440 26
			DU S&H	12,030 11	1,480 -	1,470 3	14,980 14
		2	DU S&H	9,810 8	2,470 -	1,470 3	13,750 11
			DU S&H	7,990 7	2,750 0	2,530 7	13,270 14
		3a	DU S&H	15,640 18	1,730 -	2,060 6	19,430 24
			DU S&H	10,050 8	3,370 1	2,990 7	16,410 16
1997	Low	1	DU S&H	10,050 8	3,370 1	2,990 7	16,410 16
			DU S&H	9,610 8	3,320 1	2,990 7	15,920 16
		3b	DU S&H	10,290 9	3,320 1	2,530 7	16,140 17
			DU S&H	9,610 8	3,800 2	2,530 7	15,940 17
	High	4a	DU S&H	11,300 10	2,750 0	2,530 7	16,580 17
			DU S&H	10,290 9	3,800 2	2,530 7	16,620 18
		4b	DU S&H	15,640 18	1,730 -	2,060 6	19,430 24
			DU S&H	10,050 8	3,370 1	2,990 7	16,410 16
		4c	DU S&H	9,610 8	3,320 1	2,990 7	15,920 16
			DU S&H	10,290 9	3,320 1	2,530 7	16,140 17

The aircraft fleet as a whole is expected to be significantly quieter after 1987 at Oakland and San Jose Airports due to the retirement of the older aircraft models and their replacement by new technology aircraft. Since the older models formed a larger portion of the fleet at these two airports in 1987, the change in noise impact is more dramatic than forecasted for San Francisco Airport in 1997.

Effects of a Redistribution of Airline Flights

If airline traffic is redistributed among airports as proposed in the regional plan (Alternative 3b) there would be a 9% reduction in regional noise exposure in 1987 and a 20% reduction in 1997. The forecasted noise reduction compared to the existing traffic distribution (Alternative 1) would be larger if: 1) the closest housing on Bay Farm Island was not developed as planned (these units would, however, be subject to a noise easement thus achieving technical compliance with the State's noise standards), and 2) the flight track for eastbound flights from Oakland was altered to avoid overflying northern Alameda. The shift of some traffic to a North Bay airport also contributes to the relative noise advantage of Alternative 3b.

Alternatives 4a - 4d limit passenger activity at San Jose Airport in 1997 and show that approximately 1200 fewer persons would be impacted in the San Jose area if traffic is held to 8 million annual passengers rather than 10 million annual passengers (a 13% reduction). However, there is relatively little difference in regional noise exposure between any of the traffic distributions evaluated under Alternative 4. This is because noise would be shifted to Oakland and San Francisco Airports.

North Bay Airport

Noise projections were also prepared for the four North Bay airports (Sonoma County Airport, Napa County Airport, Hamilton AFB, and Travis AFB). None of the airports have any significant land use conflicts at the present time. Comparison of Alternatives 3a and 3b shows that the diversion of a small portion of Bay Area traffic to a North Bay airport in 1987 and 1997 will reduce the population exposed to 65 CNEL in the central urbanized Bay Area by 3.3%. Most of noise relief resulting from a North Bay airport would be experienced at San Francisco Airport where the diversion would reduce the local population exposed to 65 CNEL by 7.5% in 1987 and 5.3% in 1997.

Controls on Noise From Aircraft Engines

As stated earlier, regional airport noise forecasts were prepared on the basis of full compliance with Federal requirements for retrofitting, re-engining or replacing noisy aircraft by 1987 (i.e., all aircraft meet FAR Part 36 certification requirements). This assumption is significant, since it obviously presents the "best case" in terms of future airport noise levels. An alternative fleet mix was therefore tested in which only a portion of the Bay Area airline fleet met the Part 36 aircraft noise certification requirements. (This alternative was termed "Partial Compliance.") The basis for the assumed fleet mix was testimony presented by the airline industry at various Federal

hearings on airport and aircraft noise control and FAA studies. The extent of the noise penalty which the Bay Area would have to absorb without the quieting of the airline fleet is evident from a comparison of Alternative 3b and the Partial Compliance alternative. (See Table VIII-4.) Whereas the 1987 "quiet" airline fleet would only expose 55,900 persons to noise levels of 65 CNEL or higher, the Partial Compliance alternative would impact 158,000 persons and 48 schools. This analysis points to the importance of passing Federal legislation that ensures that the airlines meet the Federal timetable for quieting the airline fleet. Recent legislation provided some waivers for two and three engine aircraft but the bulk of the Bay Area airline fleet should meet Part 36 by 1987. If the present timetable is not followed, local airport operators and jurisdictions will be required to exercise stringent controls over airport activity to achieve acceptable noise control results.

Controls on Airport Operations

The regional noise analysis also considered the impact of a complete ban on all late night aircraft flights between 10 p.m. and 7 a.m. as well as a limitation on such flights to only the newest technology (Stage 3) aircraft. (It should be noted that the FAA has recently voiced its concern that noise limits be set not by aircraft type but by drawing a "noise line" that reflects airport and community goals.) These restrictions are compared under the two alternatives labeled "Curfew" and "New Technology" for the 1997 forecast year. Notwithstanding the legal and economic ramifications of possible curfews, it was found that the regional population exposed to noise levels of 65 CNEL or greater would be reduced 48% if night operations were moved to other hours of the day. Analysis of airline flight schedules has also shown that the majority of all flights taking place at San Francisco Airport between 10 p.m. and 7 a.m. are operating out of the origin or destination airport in the same noise sensitive hours; thus, it could be argued that limitations in the Bay Area would provide an incremental measure of relief to other airports outside the Bay Area. Limiting operations between 10 p.m. and 7 a.m. to the quieter, new technology aircraft would reduce the regional population within the 65 CNEL contour 26%. (See Table VIII-4.)

SST Impacts

Airports can determine if there should be restrictions on particularly noisy types of aircraft and set non-discriminatory noise limits that apply to all aircraft (such as from standardized test data). A noise forecast was prepared to quantify the impact of 10 daily SST flights at San Francisco Airport and to better define regional policy on this subject. When 10 daily SST flights were added to the 1987 aircraft mix in Alternative 3b, it was found that the population exposed to noise levels of 65 CNEL or greater would increase 16% with the SST service.* This finding confirms earlier studies that suggest the original versions of the SST would have a significant noise impact.

*No SST flights were forecasted for the late night.

TABLE VIII-4
RESULTS OF NOISE SENSITIVITY ANALYSIS*

A) Full Compliance with Part 36 vs. Partial Compliance

1987 Population Living in 65 CNEL Contour

<u>Airport</u>	<u>Full Compliance</u>	<u>Partial Compliance</u>
San Francisco	23,560	100,010
Oakland	13,720	29,900
San Jose	18,660	27,710
Total	55,940	157,620

B) Impact of a Noise "Curfew" Between 10 p.m. and 7 a.m.

1997 Population Living in 65 CNEL Contour

<u>Airport</u>	<u>Without Curfew</u>	<u>With Curfew</u>
San Francisco	27,090	12,910
Oakland	8,740	5,510
San Jose	9,350	5,090
Total	45,180	23,510

C) Impact of Limiting Aircraft Between 10 p.m. and 7 a.m. to Newest Technology

1997 Population Living in 65 CNEL Contour

<u>Airport</u>	<u>Without Limit</u>	<u>With Limit</u>
San Francisco	27,090	22,820
Oakland	8,740	5,210
San Jose	9,350	5,270
Total	45,180	33,300

*All analyses conducted for Alternative 3b, High Forecast.

Number of Dwelling Units Within 70 CNEL Contour

An additional analysis was performed to evaluate the difference in forecasted airport noise impacts within the 65 and 70 CNEL contours. Future noise control actions for areas in the vicinity of Bay Area airports will undoubtedly consider different strategies for different areas depending on the intensity of the projected noise levels and the nature of existing land uses. More extensive forms of control would be required in the higher noise areas. Of the total Bay Area population exposed to airport noise levels of 65 CNEL or greater in 1997 it is estimated that some 10% of the population lives within the 70 CNEL or greater noise area. The 4350 persons and 1570 dwelling units in the 70 CNEL or greater noise area pose a significant land use compatibility problem.

Noise Contours

Figures VIII-1 and VIII-2 show projected noise contours at each airport under various conditions. Because of an error detected late in the study, some San Francisco Airport noise contours are slightly larger than they should be. However, the estimated number of dwelling units and population shown in previous tables have been adjusted to compensate for the calibration error.

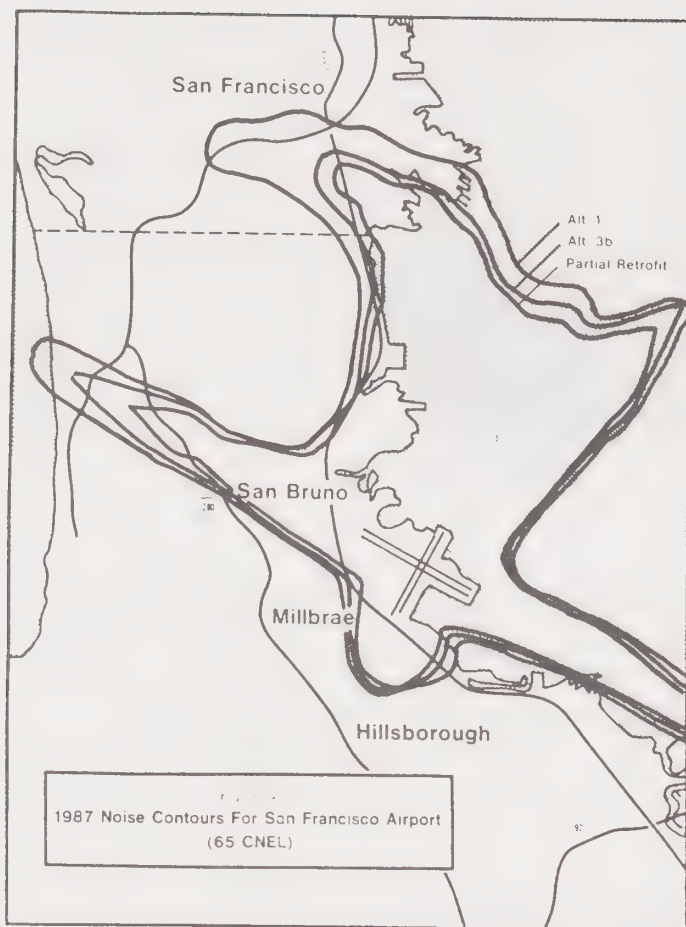
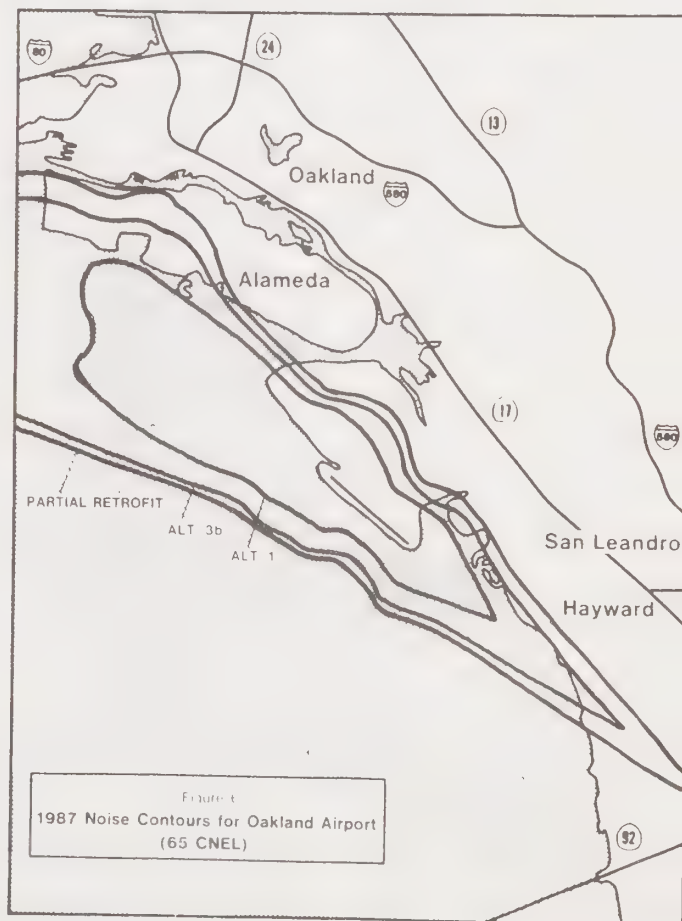
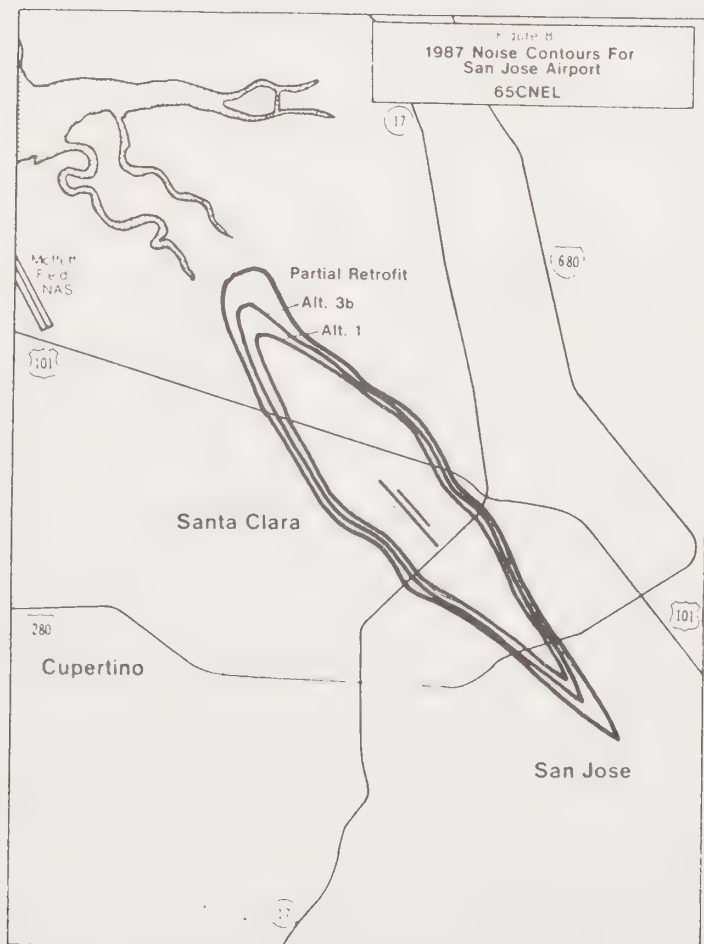


Figure VIII-1

1987 AIRPORT NOISE CONTOURS

- Alternative 1
- Alternative 3b
- Partial Retrofit



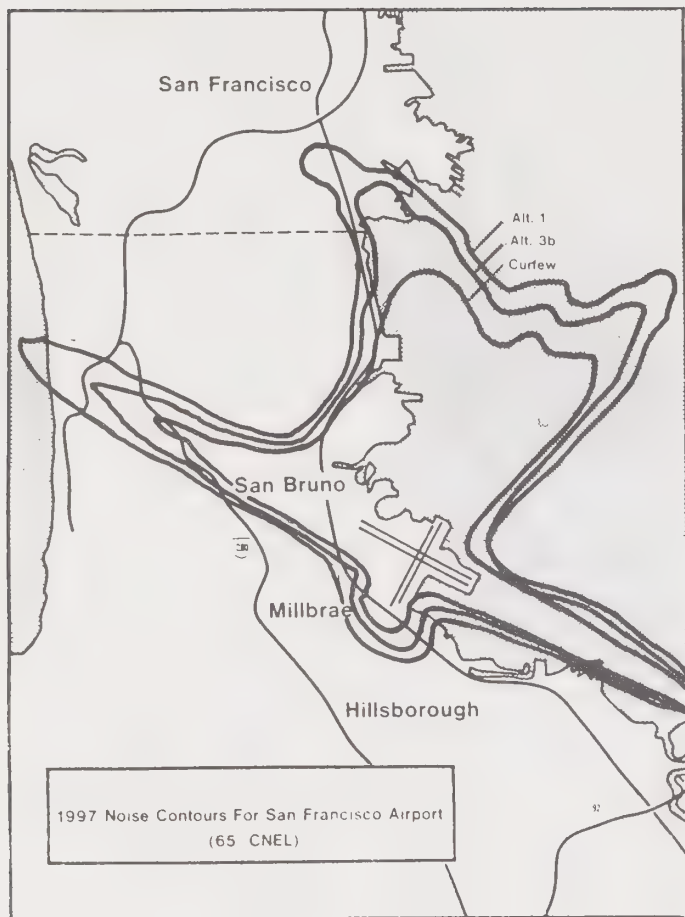
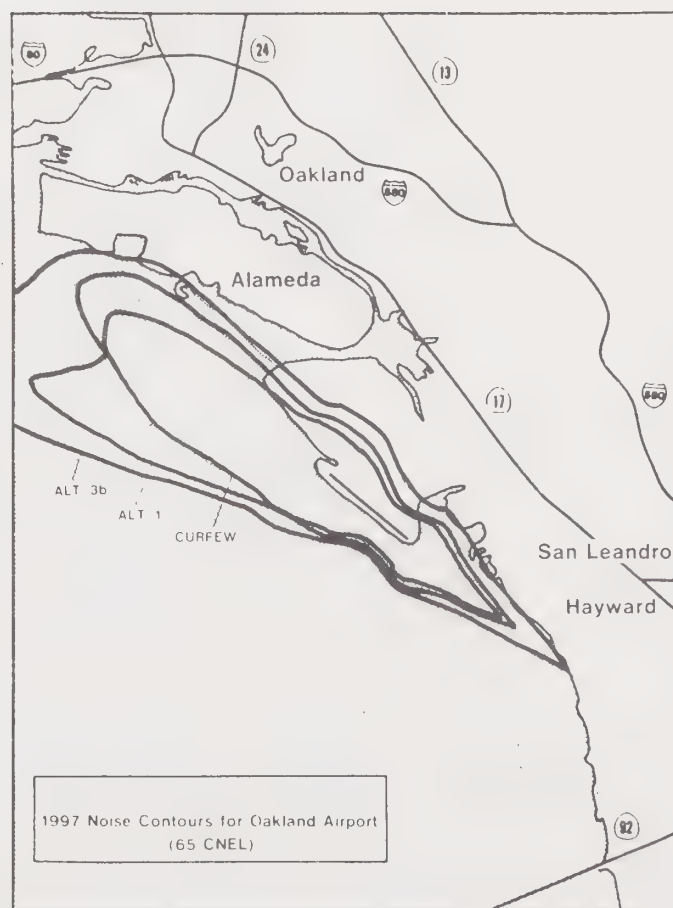
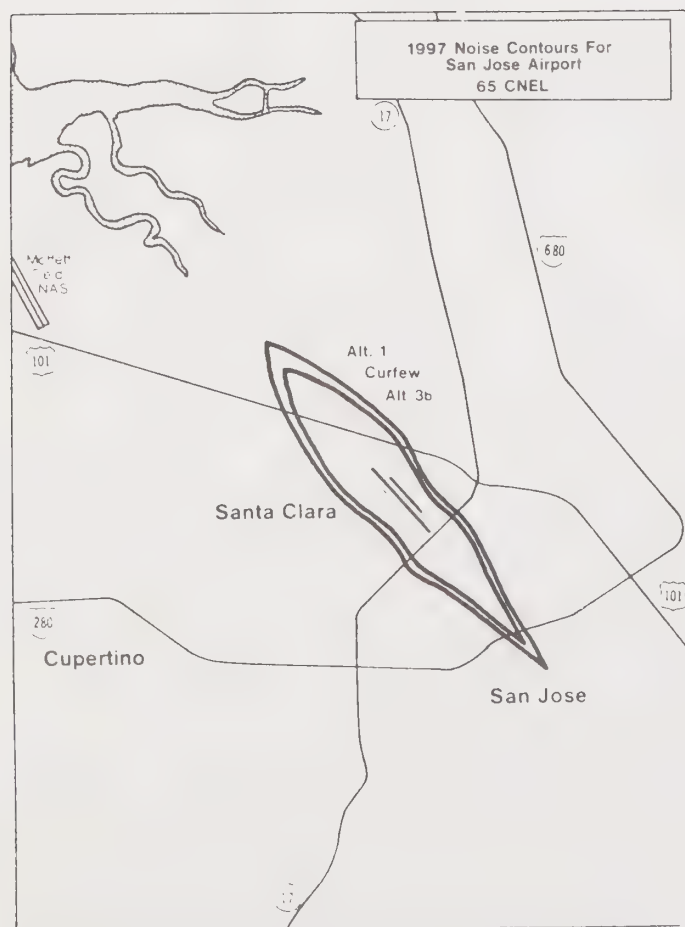


Figure VIII-2

1997 AIRPORT NOISE CONTOURS

- Alternative 1
- Alternative 3b
- Curfew



D. PROPOSALS

Noise Abatement Programs

MTC Resolution 592 expresses the Commission's interest in the development of a noise abatement program at each airport. Resolution 592 makes the preparation of such programs a condition for favorable review and approval of major airport expansion programs involving Federal aid. The airports are also requested to show evidence that they are "taking action to achieve demonstrable progress in the following specific areas which are of concern to the Commission."

- 1) Evidence from the airport's noise monitoring system that the trend in airport noise is such that future airport noise levels will not exceed the noise levels calculated under the Regional Airport Plan Update Program for the traffic allocations shown in the Regional Transportation Plan.
- 2) Evidence that the airport has, in cooperation with local jurisdictions, developed a plan for reducing the amount of incompatible land within the 65 CNEL contours calculated above.

Lead Agency: Airports

Supporting

Agency: RAPC

Action: Airport Operator - Budget resources to develop noise abatement programs. Programs developed as part of State's variance process, Airport Noise Control and Land Use Compatibility (ANCLUC) studies, or airport master planning studies will usually constitute an acceptable noise abatement program.

RAPC - Assist airport operator in developing noise abatement program. Support airport operator initiatives with FAA and CAB to establish appropriate mitigation measures.

Time Frame: Noise abatement programs should be prepared in advance of funding requests submitted to RAPC for major airport expansion or improvement projects.

Regional Strategy for Airport Noise Control

A regional noise control strategy must consider a number of different factors including:

- projected airport noise trends for the region
- the effectiveness of various mitigation actions
- the time it would take to implement the proposed actions
- differences between airports concerning how each operator is dealing with its individual noise problems
- Federal regulations concerning compliance with Part 36 certification standards
- Federal policy vis-a-vis airline deregulation and the development of non-discriminatory noise policies
- difficulty in achieving absolute compliance with the State Noise Standards.

The results of the noise analysis clearly highlighted two key parts of an effective regional noise control strategy 1) compliance of all aircraft with Part 36 standards by 1987, and 2) a redistribution of airline flights to shift flights from San Francisco to other Bay Area airports.

The proposed strategy would establish a "noise allocation" in the Bay Area that recognizes these elements as necessary and essential parts of the strategy. Each airport's noise allocation would be determined from the results of the noise analysis (as per Resolution 592) which incorporates the assumptions described earlier. Table VIII-5 shows the proposed allocations.

The allocations establish a regional goal while providing airport operators considerable latitude in developing a mix of strategies that would be most appropriate to their individual situations. If for instance San Francisco Airport was not "on track" with respect to flight redistribution, more stringent measures would be required in such areas as limits on late night operations or curtailment of operations by noisier aircraft. These allocations would form the basis for actions taken by regional agencies in the context of project review, noise variance hearings, etc.

Lead Agency: RAPC

Action: Review noise allocations with airport operators and local communities. Adopt noise allocations as a basis for regional policy development and decision making.

Time Frame: Short Range

TABLE VIII-5
PROPOSED NOISE ALLOCATION FOR BAY AREA AND
FOR INDIVIDUAL AIRPORTS

(Based on Projected Dwelling Units Within 65 CNEL Contour)

<u>Airport</u>	<u>1976</u>	<u>1981*</u>	<u>1986*</u>	<u>1987</u>	<u>1997</u>
San Francisco	12,400	10,690	8,970	8,630	8,630
Oakland	80	1,730	3,390	3,720**	3,320
San Jose	1,630***	3,800	5,970	6,400	2,990
Regional Total	<u>14,110</u>	<u>16,220</u>	<u>18,370</u>	<u>18,750</u>	<u>15,920</u>

*Interpolated on straight line basis for years when State Airport Noise Standards change to more stringent criterion.

**Assumes flight track changes to eliminate noise impacts in north Alameda.

***Actually 1975 noise contour.

PROJECTED FLEET MIX

(Average Daily Operations)

	<u>1987</u>			<u>1997</u>		
	<u>SFO</u>	<u>OAK</u>	<u>SJC</u>	<u>SFO</u>	<u>OAK</u>	<u>SJC</u>
4 Engine Wide Body	73.9	1.2	-	93.0	23.6	-
4 Engine Reg. Body	94.6	26.1	18.6	-	-	-
3 Engine Wide Body	109.3	22.3	10.5	126.4	51.8	43.2
3 Engine Reg. Body	281.5	165.4	154.6	180.0	91.0	91.2
2 Engine Reg. Body	118.2	52.6	66.4	59.8	40.6	30.2
New 200 (NT)	40.6	12.1	8.0	132.4	50.8	48.7
New 150 (NT)	15.6	.5	6.2	79.3	34.1	32.6
New 125 (NT)	9.3	5.2	3.5	101.4	54.7	34.1
Total	743.0	285.4	267.8	772.3	346.6	280.0

(NT) = New Technology

Specific Suggestions for On-Airport Mitigation

As part of the review of airport noise control strategies, the following actions are recommended for consideration by the airport operators.

- **San Francisco Airport** - Implement recommendations from Joint Land Use Study. The Joint Land Use Study has reviewed a range of strategies to control noise including:
 - establishing maximum allowable aircraft noise levels using standardized aircraft noise data
 - establishing an airport noise quota by airline
 - establishing landing fees that are based on type of aircraft and time of operation
 - revising flight procedures and flight track usage
 - constructing new runways for noise abatement

The region should review proposed actions and support those actions that lead to noise reductions consistent with the regional goal. Regional noise analyses and historical concerns of local communities indicate the need to deal effectively with noise in the late night and from loud "single events."

- **Oakland Airport** - The most significant future noise problem at Oakland Airport will be from residential development on Bay Farm Island. Existing as well as new development will be impacted. The noise impact (65 CNEL) will extend beyond the Settlement Agreement area over which the Port of Oakland has acquired a noise easement. The Port should explore means to convert projected additional incompatible areas to compatible areas at the earliest possible opportunity. Such actions will involve coordination with residents of Bay Farm Island, the developer, the City of Alameda, and the Alameda County ALUC.

As noted above, the 1987 noise contours for Oakland Airport impinge on the northern portion of Alameda Island. This results from eastbound traffic making a right turn over Alameda. In order to reduce noise over Bay Farm Island and eliminate possible noise impacts on Alameda, it is suggested that the airport and FAA jointly explore:

- a) reconfiguration of the eastbound Standard Instrument Departure route to avoid low altitude noise over Alameda Island
- b) increased use of the Silent 1 flight track for evening (7:00 p.m. - 10:00 p.m.) departures where practical and safe.

Lead Agency: Port of Oakland, FAA
Action: FAA - Review departure routes and utilization.

Port - Initiate steps to resolve future land use compatibility issues on Bay Farm Island.

Time Frame: Short and Medium Range

- **San Jose Airport** - Implement Airline/Airport Use Agreement as necessary. Recent noise studies at the San Jose Airport assume that the low level of operations presently occurring in the late evening will continue throughout the planning period. The City of San Jose recently negotiated a long term airline/airport use agreement with the airlines governing the use and occupancy of facilities on the airport. This agreement included the right of the City to regulate the hours of airport operation and should be used to the maximum extent to control late night operations. Airlines using San Jose should be encouraged to reduce the number of "fill up" flights that also stop at Oakland or San Francisco and should also be encouraged to use the newest technology aircraft at San Jose at their earliest opportunity.

Lead Agency: Airport
Action: Encourage airlines to reduce number of "fill up" flights, perhaps through economic incentives. Encourage airlines purchasing new technology aircraft to use these aircraft at San Jose as soon as possible.

Time Frame: Short-Medium Range

- **North Bay** - Local government should prevent the creation of new incompatible land uses around Hamilton AFB, Sonoma County, Napa County, and Travis AFB airports until a joint decision is reached on a recommendation for future airline service in the North Bay. Such a recommendation should be reached through a cooperative study involving local jurisdictions and the regional agencies.

Lead Agency: North Bay Cities and Counties/County Airport Land Use Commissions

Action: Through zoning and permit authority, prevent the creation of new incompatible land uses around the four North Bay airports until a joint decision is reached on their ultimate use for air carrier activity.

Time Frame: Short-Medium Range

Noise Monitoring/Noise Forecasting

An integral part of the regional noise allocation approach is a continuous reporting of airport noise contours. While monitoring data is available, this data is not directly useful in assessing noise impacts unless coupled with additional computer software that calculates noise "footprints" or contours. These contours can then be correlated with land use information (such as that developed by ABAG in the BASIS program) to assess the population and number of dwelling units falling within the contour. It is suggested that the airports develop this capability and that a noise model calibration approach similar to that used in the regional study be followed. It is believed that the airports are in the best position to develop these programs because of their relationship with the airlines and FAA Tower personnel. (A specific recommendation in this regard is that the airlines provide airports with information on the number of Part 36 aircraft operations by aircraft type.) The suggested computer programs would have the added benefit of enabling the airports to evaluate the effectiveness of potential noise abatement actions.

If this program cannot be instituted by the airports for financial or other reasons it is recommended that the regional agencies prepare updated noise contours for each airport prior to the change in the State noise criterion levels (70 CNEL in January 1, 1981 and 65 CNEL in January 1, 1986). This action will update planning data necessary for the development of effective noise abatement programs. It is further recommended that additional permanent monitoring stations be located on Bay Farm Island adjacent to Oakland Airport. The accuracy of future noise projections for this area would be significantly improved if additional data were available for noise model calibration purposes. (The two existing monitors provide good, but limited data.) It is also recommended that all noise complaints be consolidated in a computer file that would enable future statistical analysis of the relationship between areas of high complaints and the type of noise experienced (e.g., "backblast", overflight, engine testing, etc.).

Lead Agency: Airports

Action: Acquire computer software necessary to produce noise maps showing 65, 70, and 75 CNEL contours for each quarter during which noise data is collected. Evaluate additional monitor locations. Evaluate feasibility of storing noise complaint data on computer.

Time Frame: Short Range

Land Use Compatibility Criteria - ALUC Plans

Most ALUC's in the state use either the noise/land use compatibility chart designed by the State Office of Noise Control or the Federal Department of Housing and Urban Development. It is suggested that the Regional Airport Planning Committee update its noise compatibility chart by adopting the State Office of Noise Control standards.

It is also recommended that the Regional Airport Plan include local land use compatibility criteria and referral areas as developed by the Alameda, San Mateo, and Santa Clara County ALUC's. Technically this would take place through a formal staff review of plans and plan revisions and through Committee "acceptance" of these plans.

The Committee may further choose to accept the plans in their entirety or amend portions of the plans.

Lead Agency: RAPC

Action: Review ALUC plans for consistency with the Regional Airport Plan. Amend as necessary. "Accept" ALUC plans as integral part of the regional airport plan and use as a basis for commenting on local land use issues where necessary and appropriate.

Time Frame: Continuing

Remedial Off-Airport Noise Mitigation Programs

The number of persons that would live in areas exposed to noise of 65 CNEL or greater is substantial. This finding highlights the importance of off-airport land use compatibility programs. These programs typically involve one or more of the following types of actions. The appropriate mix of actions depends on the characteristics of the local community and the intensity of airport noise.

- acquire property
- acquire noise easements
- establish purchase insurance program
- insulate schools and residences
- revise zoning

Two formal land use compatibility programs have been completed in the Bay Area at San Francisco and San Jose Airports. San Jose Airport has already taken decisive action by purchasing a major area of land south of the main runway. A large area has also been identified in the Airport Master Plan for remedial sound treatment. Major attention should be focused on the 70 CNEL contour area both because of the change in State noise standards in 1981 and because of the health implications for people living in this area. As stated in MTC Resolution 592 the primary regional concern is that such programs be initiated with the local communities.

Lead Agency: Airports
Action: In cooperation with local communities, develop off-airport mitigation programs.
Time Frame: Short-Medium Range

Other Administrative Actions Available for Noise Control

Several administrative actions are available to regional agencies in the area of noise control. These include the State noise variance process and the Federal Airport Development Aid Program (A-95 review).

- **State Noise Variances** - Under the State Airport Noise Standards, airports that do not have a zero noise impact may request a variance. Variances are to be reviewed every 12 months and public hearings may be held. The State has the power to place conditions on the variance that compel the airports to take various mitigation actions.

Lead Agency: State of California
Supporting Agency: RAPC
Action: After reviewing progress, RAPC may request that the State modify or add conditions to the variance.
Time Frame: Continuing

- **Airport Development Aid Program** - RAPC has used major airport development projects to review airport expansion and improvement programs. The FAA administers the ADAP program and receives comments on the ADAP projects through the A-95 process. In some instances, the FAA has responded to local concerns by placing conditions on a grant agreement. Regional agencies can use the A-95 process to request a conditioning of the Federal funds in order to achieve a more aggressive approach to airport noise control.

Lead Agency: FAA
Supporting Agency: RAPC
Action: If necessary, RAPC should request that the FAA place conditions on grant agreements to facilitate noise reductions.
Time Frame: Variable

Legislation

Two major pieces of noise-related legislation are of continuing interest and importance to RAPC.

- **Federal Aviation Noise and Safety Reduction Act** - Although this act was initially intended to help finance new aircraft and installation of quieter engines on older aircraft, subsequent versions of the Act would have substantially delayed the earlier time schedule. Regional policy on this matter was to:

- 1) support user generated fees, if necessary, to finance the retrofitting, re-engining or replacement of older aircraft.
- 2) oppose any substantial change to the January 1, 1985 compliance deadline. (RAPC endorsed partial waivers when it appeared that the normal aircraft/engine production backlog would not permit delivery of aircraft or engines in time to meet the deadline. However, support for such waivers from the schedule was conditioned on an "early" order by the airlines.)
- 3) oppose any legislation prohibiting the application of new technology to aircraft produced before the availability of such technology.
- 4) support, in general, other provisions of the act making funds available for noise planning purposes.

Legislation was finally signed in 1980 providing some waivers for two and three engine aircraft.

- **ALUC Legislation** - Limitations in the ALUC statutes prevent these bodies from operating effectively in many instances. In addition to the 4/5 local override problem, ALUC's have no authority regarding recommendations for remedial actions in existing areas of incompatible use and have no sustained funding source. As a matter of policy it is proposed that the regional agencies support future bills that:

- a) contain provisions for dealing with existing incompatible land uses.
- b) provide a mechanism for achieving consistency between ALUC plans and local plans either by: 1) mediation between ALUC and local jurisdictions, 2) transfer of all ALUC functions to local jurisdictions for preparation of special area plans, and 3) requiring that local jurisdictions adopt the ALUC plan.

- c) recognize state and regional plans in defining noise impact boundaries.
- d) provide some linkage between land use planning responsibilities and airport responsibilities to mitigate noise.

Lead Agency: RAPC
Action: Lobby for effective legislation. Coordinate local response.
Time Frame: Short Range

Future SST Service

The Federal SST Noise Rule allows local airport operators to retain the right to ban certain aircraft types, including the SST, by adopting reasonable and non-discriminatory noise rules. The regional noise analysis has identified measureable noise impacts associated with limited SST service. RAPC should support local airport noise rules that preclude SSTs that do not meet Part 36 noise standards. (The SST could possibly use Travis AFB where adequate noise protection can be afforded.)

Lead Agency: Airports
Action: Review non-discriminatory noise policy for governing possible SST service.
Time Frame: Medium Range

Coordinate Regional Discussion on Proposed Flight Track Changes

Some proposals to reduce noise may necessitate major changes in the way airports are operated and significantly change the routing of aircraft at certain times of the day. The noise impacts of these changes may be felt many miles from the origin or destination airport. Since the use of the airspace is a regional concern and since the issue of noise equity is also regional in nature, RAPC may be able to assist the FAA in working out noise agreements between various affected jurisdictions.

Lead Agency: FAA
Supporting Agency: RAPC
Action: Assist FAA and local communities in working out proposed changes in aircraft flight paths that may be proposed for noise abatement or other reasons.
Time Frame: Variable

IX. AVIATION IMPACTS ON AIR QUALITY

A. ISSUES AND PROBLEMS

In 1970, the Bay Area Air Quality Management District prepared an analysis of the impact of projected aviation activity on air quality within the region. Since that time, many factors have changed including the air travel projections, aircraft technology and environmental laws and regulations. Because of these changes, the air quality study needs to be brought up to date in order to evaluate the importance of air quality considerations in current regional airport plans and policies.

Under the Federal Clean Air Act of 1970 and the Clean Air Act Amendments of 1977, each state is required to prepare detailed implementation plans demonstrating how the ambient air quality standards are to be met. Many California regions, including the Bay Area, have exceeded some or all the air quality standards, thus emphasizing the need for an implementation plan. The Air Quality Section of the 1979 Bay Area Environmental Management Plan describes the Bay Area's implementation plan. The deadline for achieving the air quality standards is December 31, 1982 but can be extended in areas with severe carbon monoxide and ozone problems (such as the Bay Area). This extension can be granted only if all reasonably available control measures have been implemented and if "reasonable further progress" towards attaining the standards can be demonstrated.

While the Environmental Management Plan developed for the Bay Area by ABAG, MTC, and the Bay Area Air Quality Management District (BAAQMD) does not include specific controls for aircraft or airports, it does contain many vehicular controls that indirectly affect the airports. It is important to include air quality considerations in the regional airport plan because Federal regulations require a demonstration of "reasonable further progress towards attaining and maintaining Federal air quality standards." Also, existing aviation policies concerning air quality state that the regional airport plan should 1) avoid increased aviation and ground activity in areas where the total air pollution would be significantly increased and 2) minimize airport-related pollution in communities surrounding the airports.

The purpose of airport air quality study is to provide a regional airport strategy that helps improve Bay Area air quality. Three major issues have been addressed:

- **Significance of Airport-Related Emissions** - The continued growth in demand for aviation services will have an effect on local and regional air quality no matter which airport system plan is ultimately implemented. It is necessary to gauge this impact to properly evaluate the overall significance of aviation sources relative to other sources of air pollution in the Bay Area.

- **Evaluation of Airport System Alternatives** - There may be differences between airport system alternatives from an air quality point of view. By conducting an air quality analysis, recommendations for development of airport facilities and airline service can conform to the region's overall air quality plans.
- **Effectiveness of Mitigation Measures** - The impact of selected mitigation measures must be studied to determine their effectiveness in reducing adverse air quality conditions. Based on the effectiveness of these measures, various strategies can be incorporated in an overall air quality improvement program for each airport.

B. APPROACH

The air quality study considered both regional and local air quality impacts. Within this framework, the analysis first tested the regional air quality impacts resulting from different distributions of traffic among the Bay Area Airports. The analysis concentrated on two key alternatives: Alternative 1 and Alternative 3b. (The distribution of air passengers in Alternative 1 is similar to today's airport system in that a large portion of future traffic remains at San Francisco Airport. Alternative 3b, the regional recommendation, results in a greater share of traffic being handled at Oakland and San Jose Airports.) Secondly, the air quality analysis considered the impact of airport operations on local air quality conditions. Finally, the analysis tested the effectiveness of different mitigation measures on regional and local air quality. These measures were identical to the surface traffic mitigation measures discussed in the ground access section of this report. To this list was added a control on aircraft engine emissions in the form of stricter emission standards. (Such standards are in a current Environmental Protection Agency proposal.) The four mitigation measures collectively were termed Combined Mitigation Measures (CMM). Thus, the air quality conditions evaluated included:

<u>Years</u>	<u>Alternatives</u>	<u>Mitigation Measures</u>
● 1987	● Alternative 1 (Existing Airport Shares)	● 25% Transit Use ● 25% Carpool/Vanpool Use
● 1997	● Alternative 3b (Regional Airport Plan)	● Reduced "Kiss-and-Fly" ● More Stringent Emission Controls on Aircraft Engines

Regional Air Quality Impacts

This study addressed three pollutants: Hydrocarbons (HC), Nitrogen Oxides (NO_x), and Carbon Monoxide (CO). After entering the atmosphere, the first two compounds react with each other in the presence of sunshine to form ozone. The effect of airport-related HC and NO_x discharges on ozone formation can be calculated via the use of sophisticated computer simulation models. However, these models are extremely expensive to run in terms of manpower and computer time. Their use would be warranted only if the airport-related emissions comprised a significant portion of the regional inventory. Thus, the first step in the HC and NO_x analysis is to determine the amount of airport-related emissions and then to compare these levels against the projected regional emissions inventory.

The two principal sources of airport-related HC and NO_x emissions are aircraft and vehicular traffic. To calculate these emissions, it is necessary to know:

- the number of landings and takeoffs at each airport for each aircraft type;
- the number and length of vehicle trips to the airports for each vehicle type;
- the emission factors for each aircraft type; and
- the emission factors for each vehicle type.

The number of landings and takeoffs by aircraft type multiplied by the appropriate emission factor defines the pollution due to aircraft. A major assumption used in this study is that all emission control regulations required by law as of 1979 will be enacted according to schedule. Similar calculations were carried out for vehicular traffic. Then all the emissions were summed to give the total amount of airport-related pollutants. This total was then compared to the total emissions projected for the region. If the airport-related emissions are significant, a computer simulation model can be employed to measure the effect of these emissions on regional oxidant formation.

Local Air Quality Impacts

Carbon monoxide (CO), is the principal source of local air quality problems. Carbon monoxide is considered a public health hazard. It is primarily an asphyxiant and affects most severely those individuals with anemia, cardiovascular disease and chronic pulmonary disease. High concentrations of CO tend to be found near their sources--in this study, aircraft and vehicle traffic--and concentrations decrease with distance from the source as CO is dispersed by wind.

The Federal ambient air quality standards for CO (measured in milligrams per cubic meter) have been set at:

1-hour	40 mg/m ³	(35 ppm)
8-hour	10 mg/m ³	(9 ppm)

These standards are not to be exceeded more than once a year. According to EPA guidelines, these standards are applicable to areas where the general public has access. Because of the stringent CO criteria, a "worst case" analysis must be performed. The analysis assumed that maximum emissions (those corresponding to periods of peak aircraft and vehicular operation) occur simultaneously with the worst meteorological conditions.

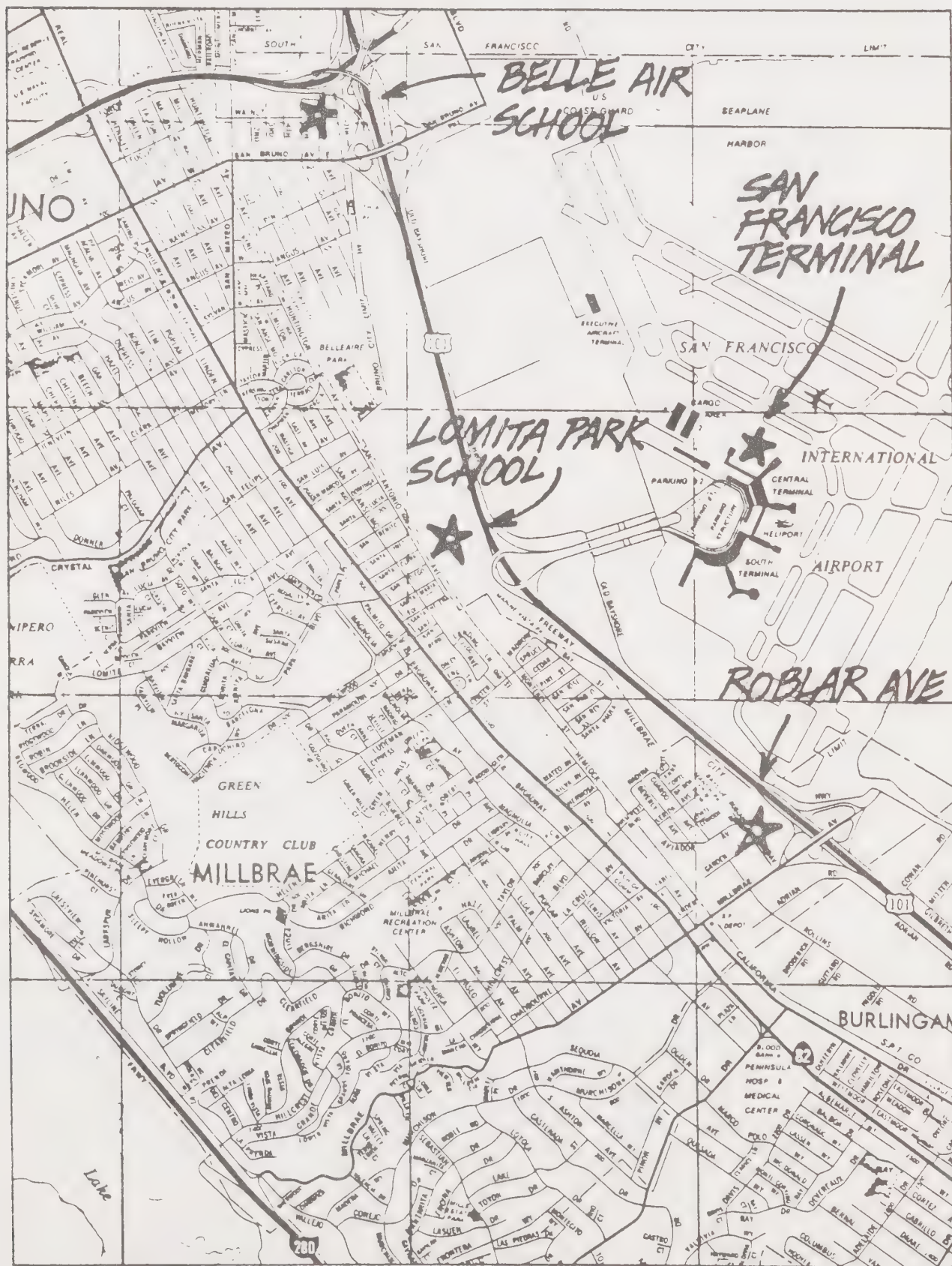
A CO analysis was performed at each of the three major airports. Because of the limited activity allocated to a North Bay airport in Alternative 3b, it was assumed that the air quality impacts would be negligible.

The approach to the CO segment of the air quality analysis was divided into a series of tasks:

- Calculate the CO emissions for aircraft and for ground traffic. This procedure is similar to that for HC and NOx.
- Select appropriate meteorological conditions. Selection of weather conditions under which CO formation is most likely is a key task in calculating CO concentrations. This selection is based on historical meteorological data collected at or near the airports. Worst case meteorology for San Francisco International Airport and Metropolitan Oakland International Airport was chosen to be "E" stability with very light winds. E stability represents an inversion condition which typically occurs during the night but can extend over to daytime hours if there is sufficiently heavy cloud cover. For San Jose Municipal Airport, a worst case of "F" stability (stronger inversion than E) was chosen. The San Jose area has less frequent winds than the rest of the Bay Area. The San Jose area also tends to have more frequent and more severe inversions. For comparison, a more typical meteorological condition, "C" stability (slightly unstable with light wind) was also evaluated for each airport.
- Select an appropriate airport operating configuration. This configuration is a runway operating pattern that is likely to be used under the assumed meteorological conditions. (San Francisco Airport only)
- Select "receptor" sites at each airport for CO calculations. "Receptor" sites are locations where CO levels were calculated. These sites must meet two criteria. One, they must be readily accessible to the public; and two, they must be sites suspected of having high CO levels. Because high CO levels occur close to the sources, sites were selected at the end of the runways and at the airport terminal curbside. (At San Francisco Airport, this analysis was performed for the upper level roadway only. The dispersion technique used to calculate CO concentrations can not be applied to the enclosed lower level roadway.) Figures IX-1 through IX-3 show the location of the receptor sites chosen for each airport. All of these are readily accessible to the public. Note that the end-of-runway sites are located where the same people will be present throughout much of the day (e.g., residences and schools). At the terminals, on the other hand, the normal length of stay by any one individual will be relatively short. Therefore, the health hazard caused by high CO concentrations is somewhat lessened. Airport employees who work near the

Figure IX-1

RECEPTOR SITES AT SAN FRANCISCO INTERNATIONAL AIRPORT

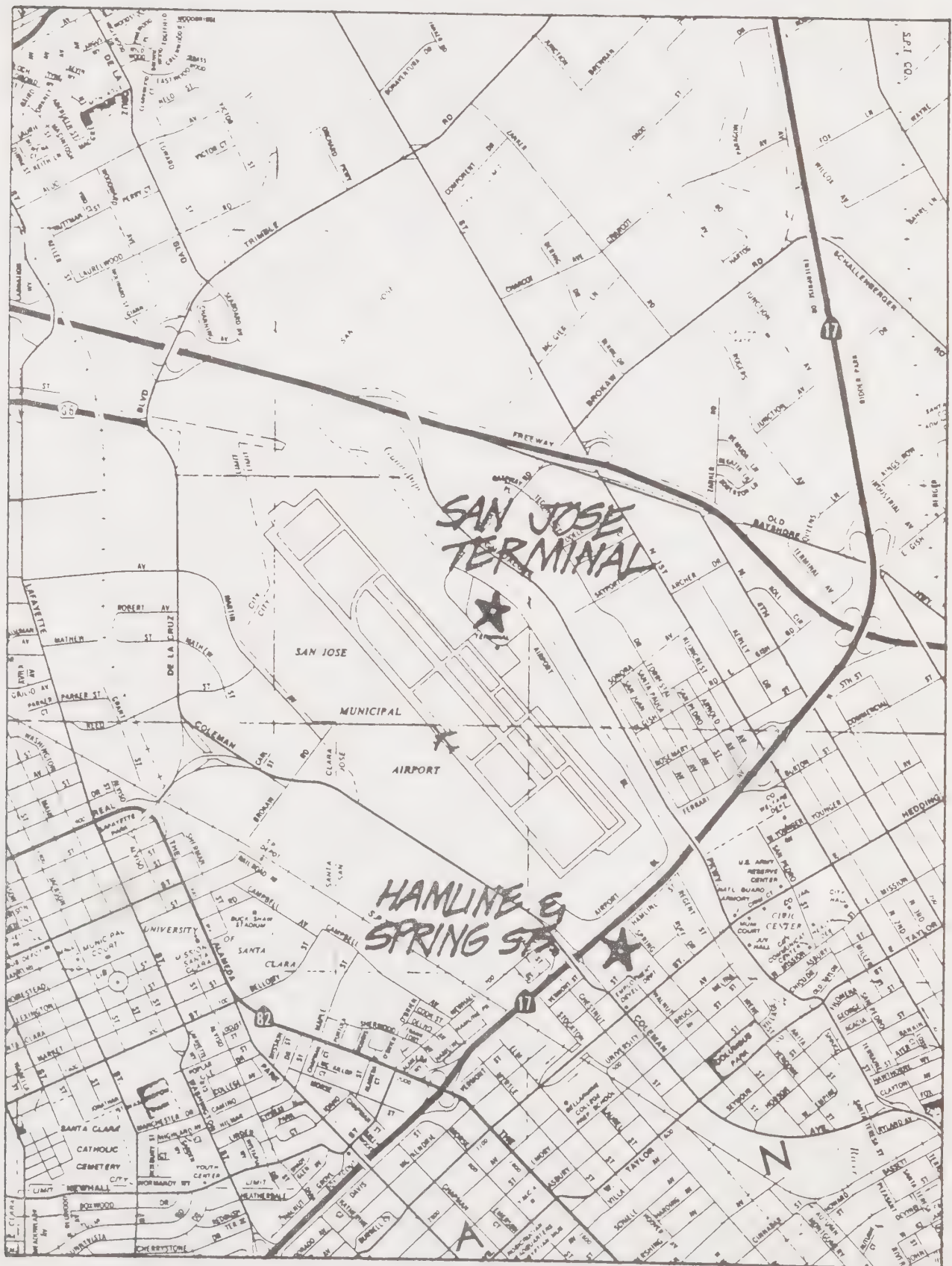


RECEPTOR SITES AT OAKLAND



Figure IX-3

RECEPTOR SITES AT SAN JOSE



curbside throughout the day would be subjected to the high CO concentrations.

- Calculate the ground level concentration for CO. Having determined total emissions, the appropriate meteorological assumptions, and location of receptor sites, the CO level at each site was calculated via standard dispersion models. For highway emissions, the EPA model HIWAY was used (see Note 1). Another model developed by the Bay Area Air Quality Management District (see Note 2) was applied for aircraft.

The CO levels predicted by the two models are then combined with the background level and the results compared to the appropriate standard. The background CO level is that concentration which would be present at the airports if the airports were not there. These CO levels are taken from actual monitored CO concentrations supplied by the BAAQMD. The background levels used for the 1975 base year are as follows:

BACKGROUND CO LEVELS (mg/m³)

<u>Airport</u>	<u>1-hr</u>	<u>8-hr</u>
San Francisco	8.8	5.9
Oakland	8.2	5.9
San Jose	17.0	11.7

For future years, background levels were computed by assuming that the Bay Area Environmental Management Plan achieves its objective and CO standards are met by 1982. Background CO levels could therefore be reduced some 55%.

1. U.S. EPA, User's Guide for HIWAY, A Highway Air Pollution Model. EPA-650/4-74-008, Office of Research and Development, Research Triangle Park, North Carolina. February 1975.
2. BAAQMD, Regional Airport System Study, Environmental Studies: Aviation Effect on Air Quality in the Bay Region. Prepared for ABAG, Berkeley, California. February 1971.

C. FINDINGS

Regional Air Quality Impacts

Table IX-1 summarizes the results of this analysis for the two contrasting airport system alternatives. As can be seen, airport-related HC and NO_x would not comprise a significant portion of the regional inventory--less than 3 percent for each pollutant under the worst case. Therefore, even if airport emissions were to be eliminated entirely, little or no effect would be detected in the regional ozone level. Also, no significant differences between the two airport system alternatives are discernible on a regional scale.

The analysis of selected mitigation measures (25% transit use and stricter aircraft engine controls), shows that airport-related HC could be reduced by 50% in 1987 and by 65% in 1997. For NO_x, the reductions would be 10 and 30% for the same years. Thus, the improvement in air quality would be in the spirit of "reasonable further progress."

Local Air Quality Impacts

- **One-Hour CO Ground Level Concentrations** - The results of the 1-hour carbon monoxide analysis for each airport system alternative are shown in Tables IX-2 and IX-3 for the light wind (C stability) and the worst case (E or F stability) meteorology, respectively. The tables indicate instances where the 1-hour standard (40.8 mg/m³) is expected to be exceeded. For C stability, only one exceedance was calculated and that was for the 1975 base year at the San Francisco Terminal. No exceedances are projected for future years.

Under worst case meteorology (E for San Francisco and Oakland and F for San Jose), Table IX-3 shows only one site, Hamline and Spring Streets at San Jose Airport, to be in violation. San Francisco and Oakland Airport are projected to meet the CO standards.

Table IX-4 shows the major CO emissions contributors for the sites that are projected to exceed the 1-hour CO standard. This table shows the relative importance of aircraft versus vehicular emissions. For example, at the San Francisco Terminal in 1975, idling autos and airport traffic contributed 32.5 mg/m³ of CO to the 42.9 mg/m³ total. For future years the contribution from idling cars will no longer be a significant factor due to implementation of more stringent auto emission controls.

At the San Jose Hamline and Spring Street site, the standards are exceeded for F stability under the worst case meteorology for nearly all cases. For the base year, the major sources are aircraft, background levels, and non-airport related traffic. Aircraft emissions are an important contributor at

TABLE IX-1

SUMMARY OF AIRPORT RELATED HYDROCARBON AND NO_x EMISSIONSHYDROCARBONS

Year	Alternate	Combined Mitigation Measures	% of REGIONAL EMISSION INVENTORY		
			Aircraft	Ground Traffic	TOTAL
1987	1	Yes	0.6	0.4	1.0
		No	1.7	0.4	2.1
1987	3	Yes	0.6	0.4	1.0
		No	1.8	0.4	2.2
1997	1	Yes	0.1	0.4	0.5
		No	1.0	0.4	1.4
1997	3	Yes	0.1	0.4	0.5
		No	1.0	0.4	1.4

NO_x

Year	Alternate	Combined Mitigation Measures	% of REGIONAL EMISSION INVENTORY		
			Aircraft	Ground Traffic	TOTAL
1987	1	Yes	1.5	0.7	2.2
		No	1.6	0.8	2.4
1987	3	Yes	1.5	0.6	2.1
		No	1.6	0.7	2.3
1997	1	Yes	1.2	0.9	2.1
		No	1.9	0.9	2.8
1997	3	Yes	1.2	0.7	1.9
		No	2.0	0.8	2.8

Table 1x-2

SUMMARY OF 1-HOUR CO EXCEEDANCES,
LIGHT WIND CONDITIONS

AIRPORT:			SAN FRANCISCO				OAKLAND			SAN JOSE	
METEOROLOGICAL STABILITY:			C				C			C	
YEAR	ALTERNATE	CMM	Terminal	Roblar Avenue	Belle Air School	Lomita Pk School	Terminal	Bay Farm Island	San Leandro Marina	Terminal	Hamline & Spring Sts
1975	BASECASE		*								
1987	1	Yes									
	1	No									
1987	3	Yes									
	3	No									
1997	1	Yes									
	1	No									
1997	3	Yes									
	3	No									

* denotes exceedances

Table 1x-3
SUMMARY OF 1-HOUR CO EXCEEDANCES,
WORST CASE METEOROLOGY

AIRPORT:			SAN FRANCISCO				OAKLAND			SAN JOSE	
METEOROLOGICAL STABILITY:			E				E			F	
YEAR	ALTERNATE	CMM	Terminal	Roblar Avenue	Belle Air School	Lomita Pk School	Terminal	Bay Farm Island	San Leandro Marina	Terminal	Hamline & Spring Sts
1975	BASECASE										*
1987	1	Yes									
	1	No									*
1987	3	Yes									*
	3	No									*
1997	1	Yes									*
	1	No									*
1997	3	Yes									*
	3	No									*

* denotes exceedances

TABLE IX-4
CONTRIBUTORS TO 1-HOUR CO GROUND LEVEL CONCENTRATION

Airport/Receptor	Year/Alt./CMM	Meteor- ology	Predicted GLC,mg/m ³	Major Contributors	Contribution mg/m ³
SFIA/Terminal	Basecase	C	42.9	Idling autos, airport traffic	22.4 10.1
SJMA/Hamline & Spring St.	Basecase	F	56.5	Aircraft Background	19.4 17.0
				Non-Airport related traffic	15.8
	1987/1/NO	F	44.1	Aircraft Background	28.3 7.7
	1997/1/NO	F	50.5	Aircraft Background	35.9 7.7

One-hour CO standard, 40.8 mg/m³.

Table1x-5

SUMMARY OF 8-HOUR CO EXCEEDANCES,
LIGHT WIND CONDITIONS

AIRPORT:			SAN FRANCISCO				OAKLAND			SAN JOSE	
METEOROLOGICAL STABILITY:			C				C			C	
YEAR	ALTRNATE	CMM	Terminal	Roblar Avenue	Belle Air School	Lomita Pk School	Terminal	Bay Farm Island	San Leandro Marina	Terminal	Hamline & Spring Sts
1975	BASECASE		*		*					*	*
1987	1	Yes									*
	1	No									*
1987	3	Yes									*
	3	No									*
1997	1	Yes									*
	1	No									*
1997	3	Yes									*
	3	No									*

* denotes exceedances

Table 1x-6
SUMMARY OF 8-HOUR CO EXCEEDANCES,
WORST CASE METEOROLOGY

AIRPORT:			SAN FRANCISCO				OAKLAND			SAN JOSE	
METEOROLOGICAL STABILITY:			E				E			F	
YEAR	ALTERNATE	CMM	Terminal	Roblar Avenue	Belle Air School	Lomita Pk School	Terminal	Bay Farm Island	San Leandro Marina	Terminal	Hamline & Spring Sts
1975	BASECASE		*	*	*					*	*
1987	1	Yes									*
	1	No		*	*					*	*
1987	3	Yes								*	*
	3	No		*						*	*
1997	1	Yes									*
	1	No		*	*					*	*
1997	3	Yes								*	*
	3	No		*						*	*

* denotes exceedances

TABLE IX-7

CONTRIBUTORS TO 8-HOUR CO GROUND LEVEL CONCENTRATION

Airport/Receptor	Year/Alt./CMM	Meteor- ology	Predicted GLC, mg/m ³	Major Contributors	Contribution, mg/m ³
SFIA/Terminal	Basecase	C	24.1	Idling Autos	12.0
		E	16.7	Idling Autos	5.5
SFIA/Roblar Ave.	Basecase	E	15.8	Aircraft	9.6
	1997/3/NO	E	12.2	Aircraft	9.3
SFIA/Belle Air School	Basecase	E	11.8	Aircraft	3.8
	1997/1/NO	E	11.4	Aircraft	7.2
SJMA/Terminal	Basecase	C	15.2	Background Airport traffic	11.7 3.5
	Basecase	F	21.5	Background Airport traffic	11.7 9.8
	1987/3/YES	F	13.3	Airport traffic Background	8.0 5.3
	1997/1/NO	C	12.5	Aircraft Non-Airport related traffic	3.0 3.0
	1997/1/NO	F	29.0	Aircraft	18.7

Eight-hour CO standard, 10.5 mg/m³.

this site because the site is located close to the end of the runway. Background levels are very significant in the San Jose area as evidenced by the 17 mg/m³ contribution. In addition to these two factors, the site is also located adjacent to Highway 17 which produces high ground level concentrations of CO from vehicular traffic.

In future years, the relative contribution of vehicular activity at the Hamline and Spring Street Site decreases due to stricter auto emission controls. However, aircraft emissions continue to increase as air traffic grows at San Jose Airport under either alternative.

- **Eight-Hour CO Ground Level Concentrations** - Table IX-5 is a summary of exceedances predicted under C stability for the 8-hour 10.5 mg/m³ CO standard. Only a few sites at San Francisco and San Jose, most of which are for the base year, violate the standard. The exception is the Hamline and Spring street site at San Jose.

The worst case results under E and F stability conditions are shown in Table IX-6. Many more exceedances are projected compared to C stability. The worst condition for San Francisco Airport is Alternative 1 without mitigation. For this case, the Roblar Avenue and Belle Air School sites would not be in compliance with the CO air quality standard for the forecast years. Under Alternative 3b with mitigation San Francisco Airport is predicted to have no violations. Oakland Airport should be within the 8-hour standard for both alternatives and for both forecast years. At San Jose Airport, where background levels are high, practically no difference is discernible between the two alternatives. Exceedances occur under most alternatives at the Hamline and Spring Street Site. Table IX-7 summarizes the major CO contributors at those sites that are projected to exceed the standards.

Conclusions

There will be violations of both the 1-hour and 8-hour standards under both alternatives. At San Francisco Airport, the best air quality conditions occur under Alternative 3b, in which Oakland and San Jose Airports are allocated a larger share of regional air passenger demand. The air quality analysis shows that shifting traffic to Oakland Airport, even under worst case conditions, does not produce any exceedances at this airport. At San Jose Airport, Alternative 1 produces slightly better air quality conditions because of the lower activity levels compared to Alternative 3b.

The major question that arises from the local air quality analysis is whether to recommend improved air quality at San Francisco Airport at the expense of poorer air quality at San Jose Airport. At the former airport, there is a larger potential for adverse air quality in

residential communities. This occurs because there are two active runways aligned towards populated areas. At San Jose Airport, on the other hand, the area around Hamline and Spring Streets is being purchased for conversion to a buffer zone between the airport and community. It is not expected that large concentrations of people will be found in this area. For this reason the redistribution of traffic to San Jose Airport represents a slightly better air quality situation.

It was also found that the mitigation measures that were studied reduced the instances of CO exceedances and severity of CO ground level concentrations. These reductions are significant for all alternatives and forecast years.

D. PROPOSALS

Stricter Emission Controls for Aircraft Engines

Stricter emission controls on aircraft engines will reduce local airport air quality problems. With the implementation of newly proposed standards, aircraft-related emissions would be reduced by nearly 20% in 1997 compared to the existing standards. According to the engine manufacturers, some technical difficulties need to be solved before the most recently proposed EPA emission rates can be met. There should be a continuing program to require that new generation aircraft engines meet tougher standards and to require that older engines be replaced with newer equipment at the end of their economic life.

Responsible

Agency: EPA

Action: Mandate reasonable, but progressively tougher, aircraft emission controls.

Time Frame: Continuing

Surface Traffic Controls

Vehicular traffic controls should be employed at all airports to minimize car congestion. Stop and go traffic emits more pollutants than traffic traveling at a constant rate of speed. Efficient traffic flow is especially important during the peak periods which are sometimes characterized by long, complex traffic snarls. Metering the flow of autos in the terminal area is particularly important due to high CO concentrations at this location.

Responsible

Agency: Airports

Action: Implement methods to smooth traffic flow at the airport terminal and other major points of congestion through installation of traffic control devices and/or enforcement of parking and stopping regulations.

Time Frame: To be addressed as part of air quality improvement programs developed by airports for major airport expansion programs.

25% Transit Use, 25% Carpooling, Reduced "Kiss-and-Fly"

The effectiveness of these measures in reducing airport surface traffic was evaluated in the airport ground access analysis. The air quality study showed that these measures can help to reduce airport traffic emissions by 20% to 30%. A higher use of public and private transit services will reduce the number of autos driving to the airport and also reduce emissions. Increased carpooling by employees and reduced "Kiss-and-Fly" activity will provide additional air quality relief.

Control of Aircraft Operations on the Airport

A recent study of operational controls for San Francisco and Los Angeles International Airports highlighted two potential strategies for reducing aircraft-related emissions (See Note 3):

- Aircraft towing
- Partial engine shutdown in taxi-idle mode

These strategies were estimated to reduce aircraft engine emissions 20-40%. Towing of aircraft would be a high capital cost item, particularly if an underground cable system was constructed. Partial engine shutdown could be implemented at negligible costs. However, since stricter engine controls are projected to greatly reduce aircraft pollution, aircraft towing may be considered a standby or supplementary measure provided the new emission standards are adopted. (At San Jose Airport, aircraft towing should be considered if the land acquisition area south of the airport is opened for intensive public use. This area is predicted to receive high ground level CO concentrations from aircraft, even with stricter engine controls.)

Responsible

Agency: Airports

Action:

Consider aircraft towing if monitoring shows major exceedances of air quality standards at receptor sites off runway ends

Time Frame:

To be addressed as part of the air quality improvement program developed by airports for major airport expansion programs.

3. Aero Veronment, Inc. 1978

X. ENERGY USE

A. ISSUES AND PROBLEMS

Energy use and conservation has become a critical consideration in planning future transportation alternatives. It is clear that the supply of energy cannot keep pace with accelerating demand. This situation has produced intensive interest in alternative energy sources and conservation methods. Transportation uses 60% of the petroleum consumed in this country while aviation uses 8% of the petroleum available for transportation. Since no practical substitutes for jet fuel in commercial aircraft are foreseen in the next 10-15 years, air travel would be heavily impacted by any government imposed petroleum allocation program.

In 1973, the Organization of Petroleum Exporting Countries (OPEC) sharply reduced the supply of oil and increased fuel prices. Jet fuel prices, which had remained around 11 cents per gallon for a number of years, rose to 25 cents for domestic operations and over 40 cents for some international operations. In addition to the fuel price increase, the Department of Energy's allocation program limited airline usage to the 1972 level of consumption. After 1974, the average cost of a gallon of domestic fuel continued to increase, reaching 70 cents per gallon in 1979. Although the Airline Deregulation Act has provided the opportunity for significant route expansion by the airline industry, a number of airline plans have been curtailed because of fuel shortages and price increases. In 1979, spot fuel shortages appeared resulting in some airlines "tankering" fuel to airports in short supply. One systemwide benefit, however, is beginning to appear. As the major airlines reduce or eliminate jet service in low density markets, commuter airlines using smaller aircraft have begun to provide replacement service. The closer match between aircraft capacity and market demand means greater fuel savings can be achieved. The high cost of fuel may also force the early retirement of some older aircraft models that are no longer economic to operate.

The response of the airline industry and the FAA to the 1973-74 energy crisis provides an indication of the types of actions that will be considered in dealing with future energy shortages. These were:

- reductions in seat-miles flown and curtailment of marginal routes;
- use of the most efficient aircraft on each route;
- use of the optimum operating speeds and altitudes;
- modifications to the air traffic control procedures to provide more direct airport arrival and departure routes;
- minimized ground time with engines running;
- increased use of flight simulators for pilot training and maintenance of flight crew proficiency.

The objective of the energy study was to assess the energy requirements of each airport system alternative. Order-of-magnitude estimates were developed for three different sources of energy consumption, the energy used by the airlines to fly from the Bay Area to major domestic and international destinations, the energy used in delays to aircraft, and the energy used in ground transportation to and from the airports. Of these three energy uses, the largest component is the airline route system. Airline fuel consumption will be minimized by those alternatives that produce the fewest number of aircraft operations and the fewest aircraft-miles.

Aircraft delays result from excessive traffic and/or bad weather. Delays are not only expensive to the airlines but increase fuel consumption. In 1977, it was estimated that nationwide 8% of the airlines' fuel consumption could be attributed to delays. Methods to reduce delay include shifting some traffic to less congested airports, reducing congestion at critical hours of the day, improving airfields and air traffic control systems, and adding new capacity when delays regularly exceed acceptable levels.

The principal factor affecting ground access energy consumption is the length of the passenger's ground trip to the airport. A reduction in the mileage driven produces a proportional reduction in energy consumption. Airport system alternatives that expand air service at more convenient airports will reduce the average length of air passenger ground access trips. A further reduction in ground access energy consumption can be achieved by shifting a larger share of passenger and employee trips to transit and carpools and vanpools.

B. APPROACH

Airline Route System

Because different airport system alternatives result in different numbers of aircraft operations and aircraft-hours flown, the route system energy consumption will vary among alternatives.

The major factors considered were:

- **Annual Aircraft Hours.** A computer program was used to calculate annual flights between each Bay Area airport and 38 major destinations. The number of flights multiplied by the average flight time to each destination determines the annual aircraft hours flown.
- **Aircraft Fleet Mix.** A separate fleet mix estimate was prepared for each stage length: short (0-1500 nautical miles), medium (1500-2500 nautical miles) and long range (greater than 2500 nautical miles). Aircraft-hours were apportioned among aircraft types according to the fleet mix estimate for each stage length.
- **Aircraft Fuel Consumption Rates.** The average amount of fuel used per "block" hour of flight time was obtained from CAB data for various aircraft types and is based on actual operating experience. Estimates of the fuel consumption rates for new aircraft types as well as re-engined existing aircraft were based on the best information available. New aircraft and re-engined aircraft offer substantial improvements in fuel efficiency.

This data was used to produce an "order-of-magnitude" estimate of the route system energy for each airport alternative.

Aircraft Delay

As the number of aircraft operations approaches the Annual Service Volume of an airport's runways, the average delay to individual aircraft increases rapidly with relatively small increases in the number of aircraft operations. The amount of air carrier delay was calculated for each airport system alternative and apportioned among the aircraft types projected to use the airport. Fuel consumption rates reflect a mixture of airborne and ground delays.

Ground Access

The amount of energy used by air passengers for ground transportation is a function of the distance traveled to the airport and the mode of ground transportation. Therefore, the ground access energy analysis considered:

- **Air Passenger Mode Choice and VMT.** One of the tools used in the development of the airport system alternatives was a computer program that estimates the number of air passengers in different origin/destination zones and distributes passengers to airports based on the type of airline service available. A separate computer program was developed to estimate air passenger and airport employee mode choice from each ground origin/destination zone to each airport. Multiplication of vehicle trips by distance to the airport produces vehicle miles of travel (VMT).
- **Energy Consumption Rates for Ground Transportation Modes.** Ground transportation modes were divided into two major categories: auto and transit. Auto fuel consumption rates were based on a turnover in the ownership of model types that will eventually achieve the mileage goals established by the Federal Energy Policy and Conservation Act. The average automobile mileage is expected to increase from 15 miles per gallon (mpg) in 1977 to 23.0 mpg in 1987 and 27.5 mpg in 1997 (Note 1). Transit trips were divided among fixed rail (BART), and local and express bus service with different energy consumption estimates being used for each mode.

1. "Evaluation of Composite Fleet Rating", Caltrans.

C. FINDINGS

Energy Demand

- **Airline Route System.** Route system energy accounts for about 98% of the energy demand associated with each airport system alternative. Increasing demand for air service will require more fuel. However, at the same time the airlines will be purchasing larger, more fuel-efficient aircraft to offset their rising energy requirements. Table X-1 shows that under the high forecast the airlines would use 45-53% more fuel in 1987 than in 1977 and 67 to 78% more fuel by 1997. However, the rate of growth in energy use will be significantly lower than the rate of growth in passenger traffic. (See Figure X-1)
- **Aircraft Delay.** Additional traffic at the Bay Area airports will cause aircraft delays to increase throughout the forecast period. Delays could result in up to 27.4 million gallons of fuel being wasted in 1997.
- **Ground Access Energy Consumption.** Increasing air passenger volumes will involve greater amounts of surface travel to and from the Bay Area airports. The improved mileage obtained from new automobiles will offset some of the increased energy demand. Ground transportation modes will consume between 27 and 33 million gallons of fuel in 1987 and between 33 and 39 million gallons of fuel in 1997. A greater use of mass transit and high occupancy vehicles compared to existing levels would lower these estimates.

Effect of Traffic Redistribution on Energy Demand

As in other parts of the update study, a critical comparison has to do with Alternative 1, which concentrates future airline traffic at San Francisco Airport, and Alternative 3b, which expands service at Oakland, San Jose and a North Bay airport.

Alternative 1 represents a better overall alternative from an energy standpoint. This advantage is due to the lower route system energy. Airlines serving Oakland and San Jose Airports in Alternative 3b must provide service at levels sufficient to meet the scheduling needs of passengers in their service areas. This situation results in increased operations compared to a system that concentrates flights at one airport. The traffic allocation in Alternative 3b does, however, minimize energy consumed in ground access and aircraft delay. This occurs because a greater number of passengers could use a closer airport and because air traffic is redistributed, thereby reducing runway and airspace congestion.

Figure X-1

AIRPORT-RELATED ENERGY TRENDS

Millions of Equivalent Gallons of Fuel used Annually

Includes: Airline Route System/Aircraft Propulsion
Ground Transportation
Aircraft Delays

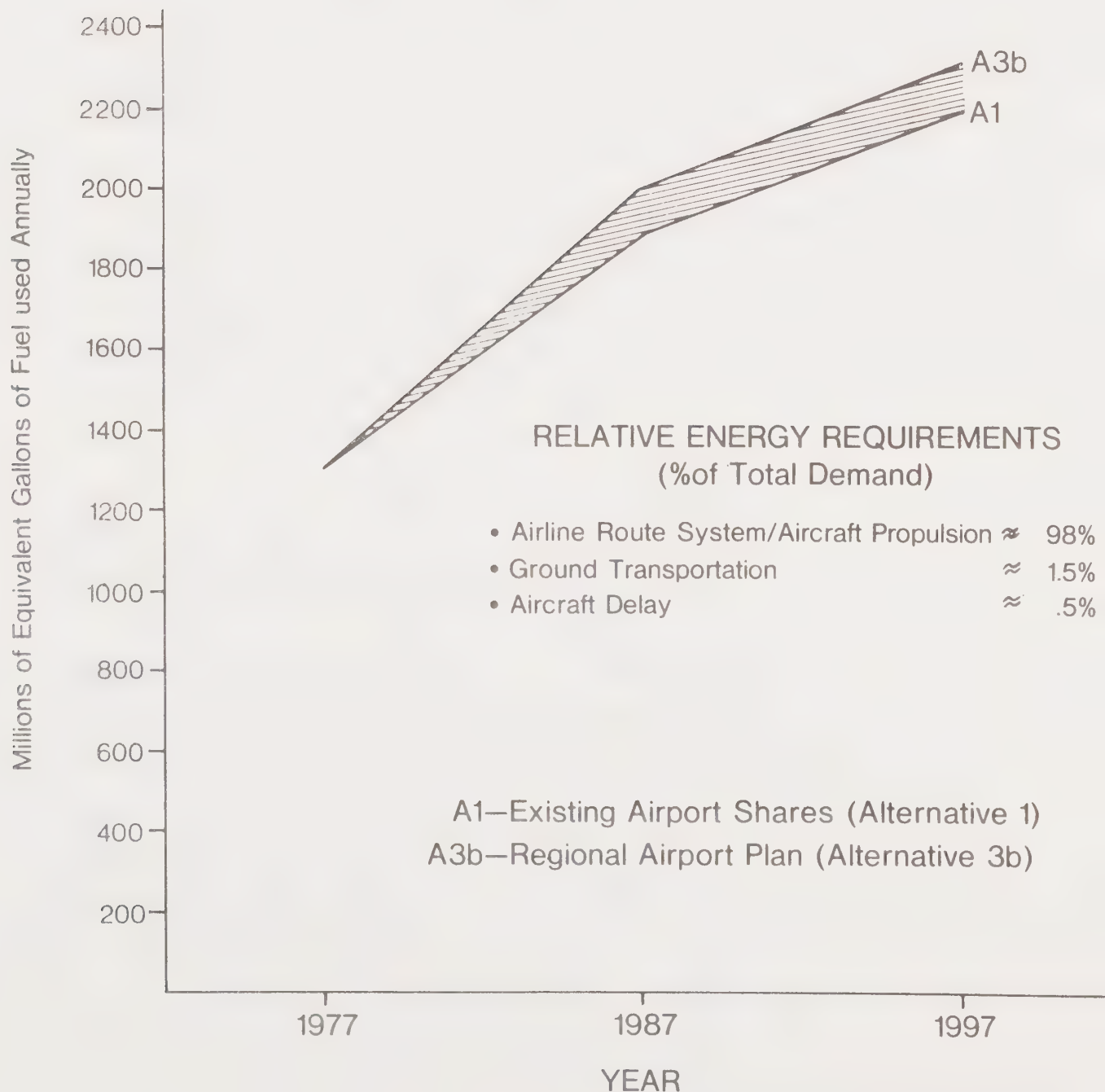


TABLE X-1

ENERGY ANALYSIS OF AIRPORT SYSTEM ALTERNATIVES

(Millions of Equivalent Gallons of Fuel Used Annually)

<u>Year</u>	<u>Forecast Range</u>	<u>Alternative</u>	<u>In-Flight Fuel Consumption</u>	<u>Aircraft Delay</u>	<u>Ground Access</u>	<u>Total</u>
1977		Existing	1275.0	3.9	25.2	1304.1
1987	Low	1	1630.7	5.9	28.4	1665.0
		3a	1708.2	3.8	24.9	1736.9
	High	1	1845.5	10.8	33.0	1889.3
		2	1930.2	7.5	31.1	1968.8
		3a	1946.7	5.7	28.8	1981.2
		3b	1949.5	5.3	27.5	1982.3
		4a	1938.7	6.1	28.3	1973.1
1997	Low	1	1789.9	10.8	33.5	1834.2
		2	1863.0	6.3	29.6	1898.9
		3a	1869.2	4.9	27.8	1901.9
	High	1	2129.0	27.4	39.2	2195.6
		3a	2264.0	8.3	34.1	2306.4
		3b	2268.7	7.3	33.1	2309.1
		4a	2262.2	8.3	34.8	2305.3
		4b	2278.9	7.6	35.2	2321.7
		4c	2290.0	10.5	36.3	2336.8
		4d	2249.4	9.1	36.8	2295.3

Alternative 1 - Existing Airport Shares

Alternative 2 - Airline Plan

Alternative 3 - Regional Airport Plan

Alternative 3b - Regional Airport Plan with North Bay

Alternative 4 - San Jose Constrained

In total, Alternative 3b would require about 93 million equivalent gallons more fuel in 1987 (4.9%) and 113.5 million equivalent gallons more fuel in 1997 (5.2%). Increased fuel consumption under the regional plan is essentially a byproduct of a system in which airports compete with each other for passengers. The energy findings would be substantially different if the allocation of service among airports could be managed in a more rational manner.

North Bay Alternatives

It is also worth comparing Alternatives 3a and 3b from an energy demand perspective. The difference between Alternative 3a and 3b is the incremental energy requirements associated with a North Bay airport.

Under Alternative 3a, intrastate passenger demand from the North Bay is served at San Francisco and Oakland Airports. Accommodating some intrastate traffic at a North Bay airport reduces the average plane load slightly for intrastate service and results in a correspondingly higher level of operations. Under Alternative 3b, approximately 2.8 million more gallons of fuel are used in-flight annually in 1987 compared to Alternative 3a. The difference in fuel consumption increases to 4.7 million gallons annually in 1997. This increase is counterbalanced by reductions in ground access energy demand (due to the shorter ground trip for some passengers) and reductions in airline delays (since North Bay airline flights overfly congested airspace).

The difference in total energy demand for the two alternatives is less than .1%.

Mitigation Measures

Technological improvements in aircraft and automobiles will lead to reduced fuel consumption as noted above. Assumptions as to the degree of improvement that can be expected have been incorporated in the energy calculations.

Additionally, increased use of ground transit to the airports has been evaluated as a potential mitigation measure. The analysis assumed that 25% of all passengers and employees would use transit to the airports. Reductions in ground transportation energy demand were estimated to range between 8 to 11% for air passengers and between 6 and 14% for airport employees. (Since most transit trips involve a combination of modes, the procedure used to estimate energy use oversimplifies mode choice behavior somewhat by assuming a passenger or employee takes a single mode from origin/destination zone to the airport.)

A recent study compares the energy of various ground transportation modes (Note 2). These comparisons suggest some key features of an energy-efficient ground transportation program. Overall, they confirm the relative energy advantages of high occupancy modes of transportation compared to the single occupancy automobile. (Fuel efficiency standards for automobiles will, however, become more stringent, narrowing the gap between the automobile and other modes.) Carpools and particularly

vanpools should be stressed for airport employees. Bus service (both express and local), "old" heavy rail (like the SP commute service) and "new" heavy rail (like BART) are attractive energy conservation modes compared to the automobile. On a door-to-door basis bus service performs better than fixed rail systems. This is because bus services generally provide broader geographic coverage and minimize the distance travelled to access a bus station or route. Also, fixed rail systems require station and maintenance energy, which increases total energy consumption.

Conservation of energy in the freight forwarding industry is also possible. Since many trucks carrying cargo to and from the airports operate at less-than-vehicle loads, additional cargo traffic could be accommodated without significant growth in truck traffic.

ENERGY REQUIRED BY URBAN TRANSPORTATION MODES

(Btu Per Passenger Mile)

Mode	Operating Energy <u>a/</u>	Modal Energy <u>b/</u>
Single-Occupant		
Automobile	11,000	14,200
Average Automobile	7,860	10,160
Carpool	3,670	5,450
Vanpool	1,560	2,420
Dial-a-Ride	9,690	17,230
Heavy Rail Transit (Old)	2,540	3,990
Heavy Rail Transit (New)	3,570	6,580
Commuter Rail	2,625	5,060
Light Rail Transit	3,750	5,060
Bus	2,610	3,070

N/A = Not applicable.

a/ Propulsion only.

b/ All forms of energy, computed on a door-to-door basis and adjusted for roundabout journeys.

2. BACKGROUND PAPER. Urban Transportation and Energy: The Potential Savings of Different Modes, Congressional Budget Office, December, 1977.

D. PROPOSALS

Maintain High Load Factors

An essential requirement for lowering the energy-intensiveness of the airline fleet is the maintenance of high load factors. (High load factors are considered to be 60+% although certain market segments can consistently sustain much higher load factors). Starting in 1978 load factors have increased sharply due to rising demand and a shortage of airline capacity. It is assumed that under airline deregulation carriers will have to sustain reasonably high load factors to generate necessary capital and operating funds.

As airlines add new flights at Oakland and San Jose Airports, it may not be possible to provide equally convenient schedules to and from each destination. Low load factors may result as passengers continue to use San Francisco Airport because of the scheduling convenience. It has been suggested that a direct surface connection between the airport terminals would remedy this situation.

For example, passengers could leave from Oakland or San Jose Airports, return to San Francisco Airport, and then use the surface connection to return to the airport of departure. Such a service could also be used by passengers connecting between flights whose most convenient flight may be through Oakland/San Jose Airports then out of San Francisco or visa versa.

Responsible

Agency: Transit Operators, Airlines

Action:

Develop air, sea, or ground connections between airports. Subsidies may be required depending on the type of service provided. Sources of subsidies would be public transportation assistance funds, airport revenues or the airlines.

Time Frame: Medium Range

Rescheduling Airline Operations

In 1977, it was estimated that delays caused U.S. airlines to use an additional 700 million gallons of fuel or over 8 percent of their total consumption (Note 3). Delays also inconvenienced travelers, detaining them 60 million hours and costing the airlines over \$800 million. These estimates present strong incentives to reduce delays. For a detailed discussion of this proposal, see the similar proposal in the section on Airport and Airspace Capacity.

Reduce Intra-Bay Airline Operations

Flights between Bay Area airports made to position or "fill-up" aircraft are still made on a fairly frequent basis. These operations are not fuel-efficient because of the circuitous routing required between airports. Reductions in fill-up and positioning operations should be encouraged because of the impact on energy use and airport noise.

Lead Agency: Airports

Action: Encourage reduction in fill-up and positioning operations through informal discussion with airlines. Provide additional apron space for overnight parking if required.

Time Frame: Continuing

Increased Use of Transit and High Occupancy Vehicles

This study confirms the energy benefits of increasing the share of airport trips made in private and public transit services and high occupancy vehicles. (A more detailed discussion of this area is found in the airport access section.) With respect to transit services, however, attention should be given to routes and schedules that maximize passenger loads. Buses that carry only a few passengers are not energy efficient.

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3. Report to the Congress - Airport Delays at Major U.S. Airports Can Be Reduced, General Accounting Office, September 4, 1979.

XI. AIRPORT FACILITIES AND DEVELOPMENT COSTS

A. AIRPORT FACILITIES AND PLANS

San Francisco International Airport

San Francisco Airport encompasses 2,340 acres. The runway configuration consists of dual, intersecting parallel runways. The north-south runways, 1R-19L and 1L-19R, are 9,500 feet and 7,000 feet in length, respectively. The other intersecting parallel runways, 10L-28R and 10R-28L, are 11,870 feet and 10,600 feet in length. Runway 28R is equipped with a Category III instrument landing system which permits operation under the most inclement weather conditions. (See Table XI-1)

The terminal complex consists of three major terminals constructed over different periods of time. The Central Terminal was opened in 1954, followed by the South Terminal in 1963 and the North Terminal in 1980. In total, the Terminal Complex consists of approximately 2,100,000 square feet of usable space. There will ultimately be 75 aircraft gate positions, 53 of which would be capable of handling wide-body aircraft. Three supplemental gates currently are used for Third Level carriers.

Parking facilities consist of the Central Garage--which will ultimately accommodate 7000 cars when the current construction program is completed--and a remote economy lot which holds 2600 vehicles.




The United Airlines Maintenance Base, one of the largest airline maintenance operations in the world, is located on 140 acres of leased land. This facility is United Airlines' main maintenance base and contains 2,871,000 feet of building and hangar floor area. In addition United leases a 416,000 square foot hangar and maintenance shop. Less extensive maintenance facilities are operated at the airport by a number of other airlines. Over 540,000 square feet of building space has been developed for cargo handling and storage on the airport.

Construction of major airport improvements was begun in 1968 and will continue into the mid-1980's. These improvements have covered a number of areas including construction of new aprons and taxiways, construction of the new North Terminal, expansion of the central parking garage, demolition and reconstruction of older passenger boarding areas, development of a sewage treatment plant and industrial waste treatment plan, road graphics and landscapings, etc. One of the major tasks still to be accomplished is the relocation and expansion of the international arrival facilities and provision of new customs facilities.

About 260 acres of airport property are currently undeveloped; 180 acres of this land is located in the area called the West of Bayshore property. The largest remaining undeveloped parcel east of the Bayshore Freeway is 44 acres of land on the southeast shore of the Seaplane Harbor. There are plans for development of this site by two major all-cargo airlines. The airport will be preparing a comprehensive master plan for the remaining undeveloped areas in the future.

TABLE XI-1

AIR CARRIER AIRPORTS

Airport	Schematic	1978 Activity		Acres of Land	Runways				Navigational Aids	Terminal		Cargo	
		Annual Passengers	Annual Air Carrier Operations		No.	Orientation	Length X Width (Feet)	Lighting		Number of Gates	Total Area (Sq. Ft.)	Number of Buildings	Total Area (Sq. Ft.)
San Francisco International		17,564,033	293,522	2,265	4	1L-19R 1R-19L 10L-28R 10R-28L	7000 X 200 9500 X 200 11,870 X 200 10,600 X 200	MIRL Short ALS ALS, MIRL ALS, MIRL, TDZ, CL	ILS ILS, VASI ILS (CAT III)	7 ¹	2,106,000	1 ⁵	544,225
Oakland International		2,164,243	48,969	1,600	1	11-29	10,000 ² X 250	ALS, MIRL, TDZ, CL	ILS (CAT II)	13 + 3 Transporter Gates	242,130 ³	2	64,860
					3	27L-9R 27R-9L 15-33 (Crosswind)	9611 X 150 5450 X 150 3400 X 75	MIRL ALS, MALS-RAIL Edge Lights	ILS (CAT I)				
San Jose Municipal		2,662,140	60,546	1,000	3	12L-30R 12R-30L 11-29 (Training)	4,419 X 150 8900 X 150 3000 X 40	MIRL ALS, MIRL, TDZ, RAIL	VASI	11 ⁴ Boarding Areas	141,400	1	19,200

FOOTNOTES

1. Includes New North Terminal
2. 2500 Ft. extension planned
3. Includes Terminal, Ticketing and Baggage Claim, Finger Building, and International Arrivals Building
4. The apron itself has 13 aircraft parking positions.
5. Buildings range in size from 7,000 square feet to 102,000 square feet.

Metropolitan Oakland International Airport

Oakland Airport is physically and functionally divided into two independent facilities, the North and South Airports. The South Airport is the main air passenger and air cargo facility and encompasses 1,600 of the 2,500 acres of land inside the airport perimeter dike. The main South Airport runway, 11-29, is 10,000 feet in length and is equipped for Category II instrument landings. A 2,500 foot extension is planned in the future.

The passenger terminal complex consists of several structures totaling over 240,000 square feet. These include the Terminal, Ticketing and Baggage Claims Building, the Finger Building and the International Arrivals Building. Construction of a second level over the Finger Building is underway and will enable the airport to serve larger aircraft. There will be twelve aircraft gate positions when this project is completed, one fewer than there are now. Expansion of the aircraft parking ramp to provide additional remote parking positions is also planned.

The public parking lot provides 3,000 spaces for auto storage. Two air cargo buildings have been constructed with a total of 65,000 square feet. The \$11.1 million World Air Center was completed in 1973 and is capable of handling four 747's or six DC-10's simultaneously.

The first phase of the Passenger Terminal Complex Expansion Program is designed to provide convenient terminal facilities for handling 4 million annual passengers. This project includes a second level over approximately half of the Finger Building, expanding aircraft gate waiting areas and introducing passenger loading bridges. An additional baggage claim carousel at the end of the Ticketing Building will provide increased capacity. A pilot program is underway to evaluate the use of Passenger Transport Vehicles (PTV's) to carry passengers from gates in the Terminal Building lobby to aircraft parked away from the terminal area.

In order to eventually accommodate 6 million annual passengers--the ten year Master Plan design level--several further additions to the Terminal Building will be necessary. A new Baggage Claim Building at the east end of the Ticketing Building will provide additional baggage claim capacity and allow the present baggage claim area in the Ticketing Building to be used for needed ticket counter expansion. Completion of the second level of the Finger Concourse will provide a total of 12 jetway boarding gates. Four additional gates will be provided either through construction of a second finger concourse or by implementing the PTV concept in a new structure opening off the Terminal lobby. Either plan will be designed to facilitate continued gate expansion beyond the 10-year period with minimum disruption to facilities in use.

San Jose Municipal Airport

San Jose Airport occupies 1,000 acres of land. The airport consists of three parallel runways: 12R-30L, 12L-30R, and 11-29. Runway 12R-30L is 8,000 feet long and is used for air carrier operations and business jets. Runway 12L-30R is 4,419 feet long and is used for non-jet general aviation operations. Runway 11-29 is used primarily for "Touch and Go" training operations. The main runway is equipped with an Instrument Landing System for approaches from both ends.

The airport terminal was built in four stages starting with the main terminal which was constructed in 1965. A 40,000 square foot south concourse was added in 1965 and included a second level office area and seven aircraft boarding lounges. The single level baggage claim and car rental lobby was added in 1971 on the southeast side of the terminal. Finally, the ticketing and check-in area was expanded in 1972 and two passenger boarding lounges were added in the terminal.

Total vehicle parking capacity in the terminal area is about 2,900 spaces. A 19,200 square foot air cargo building was constructed southeast of the terminal.

The airport has recently completed a Master Plan to guide future improvements up to a volume of 8 million annual passengers. It is recommended that the terminal be expanded in a linear fashion to provide the needed number of aircraft gate positions (25-31). A second level to the terminal could be constructed if required. The terminal would be served by a linear roadway extending the length of the building. Key elements of the ground access plan include a new interchange between the Guadalupe Expressway and Route 17 and reconstruction of the existing at-grade intersection at Brokaw Road and the Guadalupe Expressway (possibly involving "fly over" ramps which would permit unrestricted access-egress from the Terminal). The Master Plan also shows a requirement for 12,800 parking spaces, including public, employee and rental car spaces.

In order to provide some noise reduction over San Jose, the Master Plan recommends that the main runway be extended. Also extension of the secondary parallel runway 12L-30R has been proposed to enable the airport to continue to operate when the main runway is closed for repairs or for emergencies.

Finally, the Airport Master Plan identifies the need to provide additional air freight facilities and recommends reserving 25 acres for possible future all-cargo operations. Additional areas have also been reserved for expansion of other key facilities.

B. AIRPORT FINANCING AND CAPITAL IMPROVEMENT COSTS

Each of the Bay Area airports will need to provide capital improvements in the ensuing years to upgrade and expand their facilities. As San Francisco Airport's expansion and modernization program comes to an end, the emphasis will change to development programs at Oakland and San Jose Airports. Because of the greater uncertainty concerning traffic growth at these airports, improvements will need to be planned in stages and maximum flexibility will be required of new facilities. Continued high inflation rates will add to the expense of future airport improvement programs at all airports.

As a result of airline deregulation, airport financing will become more challenging. Airlines are freer to come and go, which could cause major fluctuations in airport revenues. At the larger airports throughout the nation (such as San Francisco), airline deregulation initially produced tremendous pressures to build new, exclusive-use terminal facilities for new carriers and for incumbent carriers seeking to expand their route systems. The risk in responding to such demands is large; the travel market can abruptly change while the financial obligations incurred to build new facilities remain over many years. San Francisco Airport will continue to experience pressures from new carriers wanting to serve the Bay Area through this airport.

In the long run energy problems, inflation, and increased competition may make airlines reluctant to participate in financing major capital improvements, particularly at airports such as Oakland and San Jose. At these airports, substantial capital investments will be required in the future, and these investments will be large in relation to the market served. Traffic growth will be heavily influenced by airline commitments at San Francisco and the natural tendency of airlines to gravitate to the larger hub airports when economic conditions worsen. Therefore, the conditions under which major expansion programs can be launched must be carefully selected in order to assure financial success. The ability of these airports to enter into long-term agreements with the airlines will be a key cornerstone for future improvement programs.

Because of the different airport roles and development cycles, the financing capabilities of each airport are also different. Large airports such as San Francisco can generate sufficient internal revenues to finance a large percentage of their capital and operating needs. A comparison of airport revenues for Fiscal Year 1977-78 showed that San Francisco Airport produced a net income of \$10,447,000 compared to \$648,000 at Oakland and \$1,032,000 at San Jose Airport. Oakland and San Jose airports, however, will rely to a much greater extent on Federal aid to construct necessary improvements. Federal money comes from an aviation Trust Fund derived from taxes on airline tickets, air freight, general aviation gasoline sales, and other miscellaneous sources. Recently a number of suggestions have been made that would substantially alter Federal financing of airports.

One such suggestion calls for "defederalizing" the airport system by doing away with the Trust Fund for larger airports. These airports would then have to renegotiate their rates and charges with airport users to provide the necessary financing for operations and airport improvements.

Airports generate revenues from a number of sources, such as landing fees, terminal and other building rentals, aviation fuel sales, parking facilities, airport transportation companies (rental cars, taxis, buses, etc.), gift shops and restaurants. Airport landing fee agreements are established at each airport. These agreements are usually subject to readjustment at specific periods in order to cover residual airport costs. Landing fees currently vary from \$1.70 per thousand pound landing weight at San Francisco Airport to \$.65 at Oakland and \$.85 at San Jose Airport.

Since the creation of the Federal Aviation Trust Fund in 1970 (Public Law 91-258) each of the Bay Area airports has received Federal aid for eligible projects. The amount of Trust Fund money an airport is eligible for is determined by the number of passengers "enplaned" at the airport. Discretionary funds are also available based on the merit of the project. Most airfield improvements (runways, taxiways, aprons, lighting and navigational aids) are eligible. Trust funds can also be used to develop public use portions of a terminal or purchase land for noise compatibility purposes. The amount of Federal aid received through the Airport Development Aid Program at San Francisco, Oakland and San Jose Airports since 1970 is approximately \$32.5 million, \$14.4 million, and \$11.4 million, respectively.

San Francisco International Airport

As of 1978, the total cost of the San Francisco expansion and modernization program was estimated as follows:

TABLE XI-2

SAN FRANCISCO AIRPORT CAPITAL IMPROVEMENT PROGRAM

(1978 Dollars)

<u>Major Component</u>	<u>Total</u>
North Terminal	\$ 64,796,000
Central Terminal	29,680,000
South Terminal	73,919,000
Ground Transportation Center	95,743,000
Terminal Service Support Facilities	28,249,000
Airfield Facilities	32,267,000
Airport Service Facilities	17,201,000
Total	<u>\$348,855,000</u>
Professional Services	44,440,000
Contingencies	13,890,000
Relocations	3,000,000
Total Program Costs	<u>\$403,185,000</u>

Inflation and delays have since added to the cost of the program. Much of the first phase of the program involving the construction of the North Terminal, Airfield Facilities, Ground Transportation Center (Parking Garage), Airport Service Facilities and Terminal Service Support Facilities is completed or will be completed in the near future. (This phase was estimated to cost a total of \$244 million, excluding the Control Tower, in 1978 dollars). The remaining work is currently estimated to cost between \$206 and \$255 million depending on the ultimate scope of the program, timing of construction, and availability of funds. This phase will be oriented towards construction of new boarding areas for the Central Terminal, development of an adequate Federal Inspection Services facility, and remodeling of various terminals.

Airport improvements have been paid for from General Obligation Bonds (\$98 million), Series A Revenue Bonds (\$143 million), Series B Revenue Bonds (\$90 million) and airport operating funds derived from airport internal funds, Federal aid, and the airlines and other airport tenants. Between 1968 and 1974 several major airline hangars, office areas, and air cargo facilities were financed using bonds issued by the San Francisco Airport Improvement Corporation, a non-profit corporation. These bonds were secured by the leases of the individual carriers. When the leases expire, the facilities will revert to the airport.

Metropolitan Oakland International Airport

Capital improvement costs for Oakland Airport are shown in Table XI-3. These costs represent the costs in 1977 dollars of the recommendations contained in the ten year airport Master Plan.

The Oakland Airport has suggested that the following conceptual costs be used for incremental improvements beyond the 6 million annual passenger level.* These costs correspond to logical stages of development as well as to various planning levels evaluated in the regional update study.

8 MAP - \$24 million
10 MAP - \$26 million
13 MAP - \$25 million

Most of the major construction at the South Airport was initially financed by general obligation bonds; however, a substantial portion of these bonds was retired using revenues from Port operations. More recent improvements on the South Airport have involved the use of Federal aid and a small amount of funds from the sale of Port revenue bonds. (Revenue bonds have been used to finance all or portions of such projects as parking lot improvements, the Passenger Transport Vehicles, and the 2nd level of the Finger Building.) Construction of the World Air Center maintenance hangar and office space was financed through a grant from the Federal Economic Development Administration.

*The plans used for these estimates are purely conceptual in nature; the Airport Master Plan considers only those projects needed to reach 6 million annual passengers and no master planning beyond this point has been done to date.

TABLE XI-3

OAKLAND AIRPORT CAPITAL IMPROVEMENT PROGRAM

(1977 Dollars)

<u>1976-1981 Program</u>	<u>Cost</u>
Second Level Finger* Building, Add Jetways, Phase I	\$ 4,700,000
Baggage Claim Building	3,300,000
Extend Runway 11/29, Strengthen Dike	2,550,000
Widen Airport Drive	2,100,000
Second Level Finger Building, Phase II	2,000,000
Aircraft Parking Apron, Phase I	1,000,000
Extend Alan Shepard Way	260,000
Additional Parking	240,000
Electrical Service Modification, Phase II	300,000
	<hr/>
	\$16,450,000
 <u>1981-1986 Year Program</u>	 <u>Cost</u>
Second Level of Finger Building, and Jetway, Phase III	\$ 6,000,000
Additional Aircraft Gate Facilities	5,000,000
Aircraft Parking, Phase II	1,250,000
Parking Garage	7,500,000
Overlay Airport Drive	100,000
Service Road, West Holding Apron to West Dike	300,000
Service Vehicles and Equipment Pad	250,000
Inter-Airport Service Road	1,800,000
Inter-Airport Taxiway	2,200,000
Extend Taxiway No. 2	2,730,000
Service Road Along Levee From Airport Drive	1,400,000
	<hr/>
	\$28,530,000

*Under Construction

San Jose Municipal Airport

Capital improvement costs for construction of new facilities at San Jose Airport are shown in Table XI-4. Total costs for the first stage of improvements are estimated to be \$74 million compared to \$39 million for the second stage. These stages correspond roughly to passenger activity levels of 5.3 and 8.0 million annual passengers, respectively.

The airport has financed improvements from a series of general obligation bonds issued between 1957 and 1967 totalling \$8.9 million in principal and from the more recent sale of revenue bonds. The general obligation bonds were primarily used for construction of the terminal and various airfield improvements. (A revenue note was also issued for \$.6 million during this period.) Between 1974 and 1980, revenue bonds totalling \$30 million were sold. A large portion of this money has gone towards acquisition of land in the Coleman Loop area south of the airport.

C. PROPOSALS

Revisions to the Apportionment Formula for Allocating Aviation Trust Funds to Air Carrier Airports

The formula for apportioning money from the Federal aviation Trust Fund should be revised. Under existing legislation, funds are apportioned directly to individual airports based on the number of "enplaned" passengers. This formula does not recognize future airport development needs or changing development priorities within a system of airports. It is therefore recommended that a revised method of apportioning funds be developed for areas where there is an adopted regional airport system plan. A single enplanement fund should be created for the region based on enplanements of all airports comprising the regional system. A five year Transportation Improvement Program should be prepared cooperatively by the airport operators and regional agencies and submitted annually to the Federal Aviation Administration. Federal funds should be apportioned to the Bay Area airports based on the program submitted.

Lead Agency: RAPC

Role: Propose revisions to existing legislation

Time Frame: Short Range

Role of a "Passenger Facility Charge" in Airport Financing

The need for a "head tax" or passenger facility charge should also be considered in developing airport financing recommendations. In order for Bay Area airports to meet future demands, improved ground transportation facilities will be required. Also, to provide greater community compatibility, airports may be required to initiate major residential sound treatment programs. There are no direct sources of funds for such programs. A "passenger facility charge" would produce a direct user-based fee to help finance these programs. At Oakland and San Jose Airports, revenues from such a charge could also be used to augment local matching funds for Federal grants (it should be noted that the "head tax" has been prohibited by Congress since 1973 and would therefore require congressional approval).

Lead Agency: RAPC

Role: Propose changes to existing legislation

Time Frame: Short Range

XII. EMPLOYMENT PROJECTIONS AND IMPACTS

A. ISSUES AND PROBLEMS

The last comprehensive regional review of airport employment was conducted in 1971 as part of the earlier Regional Airport Systems Study (RASS). The results of this study were included in a report entitled The Effect of Aviation on Physical Environment and Land Uses, (Wilsey and Ham, 1971). This report helped provide the foundation for subsequent airport employment and land use studies and for various environmental impact reports (EIR) prepared for the three major Bay Area airports.

Airport employment projections are necessary to assess future airport access and parking requirements. They are also helpful in understanding the amount of off-airport land necessary to accommodate new hotels and freight handling businesses desiring proximity to airports. Finally, the employment projections can assist public officials in understanding how airports stimulate the Bay Area economy through the provision of new jobs.

In reviewing past projections, three specific areas deserve critical review:

First, the RASS report projected substantially greater growth in air passenger activity than has materialized. These projections, in turn, resulted in unrealistically high employment projections.

Second, the earlier employment projections, and those made in subsequent EIRs, failed to recognize how the different regional role played by each airport affects airport employment characteristics. For example, San Francisco Airport functions as the domestic and international gateway to the Bay Area and its employment characteristics reflect that function. Oakland Airport serves a large intrastate market and is the home base for two major charter airlines. Both Oakland and San Jose Airports provide significant general aviation facilities and services.

A third observation about the earlier projections is that they did not make a distinction between the different stages of development at each airport. Analysis of airport employment patterns indicates that there is a basic level of service that all airlines are required to provide regardless of the number of flights or passengers served at an airport. This means that future employment growth at Oakland and San Jose Airports will be disproportionately large compared to San Francisco because of the potential increase in new airlines at these airports.

In summary, past employment projections tended to treat all three airports in an equivalent manner and did not recognize their different regional roles. Employment projections developed in this report explicitly consider these factors.

B. APPROACH

People employed in or around airports in the Bay Area can be classified into seven categories. These categories include:

- (1) Airline employees--flight crews, sales personnel, reservation and ticket personnel, aircraft service and maintenance, public relations, management, cargo handling.
- (2) Airport services--airport management, airport security, maintenance, on-airport parking, restaurants, airline caterers, car rental, gift/candy shops, banks, barbers, etc.
- (3) General aviation-related employees--aircraft storage and maintenance, charter aircraft, corporate aircraft, flight schools, aircraft parts, aircraft rental, aircraft financing and insurance.
- (4) Government employees--U.S. Customs, air traffic controllers, weather service, postal.
- (5) Hotel employees.
- (6) Freight handlers (exclusive of airline employees)--shippers, forwarders, truckers, warehousing, assembly, documentation.
- (7) Employees in businesses desiring close proximity to airports--lightweight parts manufacturers, miscellaneous business and professional services, off-airport car parking and rental agencies.

Information on current employment at each airport in the various categories above was obtained from the 1977 Caltrans/MTC Airport Employee Survey. All figures shown in this report represent total airport employment and should not be confused with the average daily work force on the airport which can be considerably lower.

The method for projecting future employment and land use is as follows:

- (1) Estimate from past trends the number of airline employees and airport employees that are required to serve a given mix of airline flights at each of the three airports. Airport-by-airport adjustments will be made according to such factors as the airport's potential for new airline tenants, economies of scale, and availability of land;

- (2) Estimate future general aviation employment as a function of projected general aviation operations at each airport and availability of land for expanded general aviation activities;
- (3) Estimate the number of government employees at each airport as a ratio of total airline operations and passengers, adjusted by airport economies of scale;
- (4) Estimate the increase in hotel rooms and hotel employment as a function of passenger activity and modified by local conditions such as land availability and competition with other hotels; and
- (5) Estimate increases in freight handling employment as a function of total cargo arriving and departing at each airport.

C. FINDINGS

Airline Employees

The number of airline employees working at an airport varies according to the services that airport provides the region. San Francisco Airport accounts for roughly 96% of all airline employees in the Bay Area. There are ten times as many airline employees per flight at San Francisco as there are at other Bay Area airports. This reflects a number of conditions. First, more employees are required for the larger airplanes flying the transcontinental routes from San Francisco Airport. Second, flight crews flying the West Coast runs from Oakland and San Jose Airports make more than one flight per day, thereby producing a relatively low employee per flight ratio. (Intrastate flight crews flying out of Oakland and San Jose also tend to be based in Southern California. Third, the large volume of cargo handled at San Francisco requires more cargo personnel.

Airport Services

The number of airport service employees working at the three Bay Area airports also reflects the volume and type of airline activity. There are far more airport service employees at San Francisco Airport than at the other two airports. Additionally, it is apparent from the number of employees per passenger at San Francisco Airport that the size of the airport enables some economies of scale; it takes slightly fewer service employees per passenger or flight at San Francisco Airport than it does at either Oakland or San Jose Airport.

General Aviation

All three major airports also serve general aviation. However, there are substantial differences in the level of general aviation activity at these airports. A large number of general aviation businesses providing services to locally based aircraft owners are located at Oakland and San Jose Airports. However, there is only one major general aviation Fixed Base Operator at San Francisco. Growth in general aviation activity and employment will primarily depend on the amount of land each airport is willing to allocate in the future to general aviation use.

Government

Several observations can be made concerning government employment at the airports. First, the majority of government employees at San Francisco and Oakland Airports are not directly tied to the number of passengers or flights (e.g., Coast Guard, Postal Service). Therefore, assumptions on growth in government employment must treat employees working directly on flights (FAA Tower or Customs employees) differently from those merely located at the airport. Second, both the mix and number of general aviation and airline operations are key determinants in how many FAA Tower officials are required at each airport. San Francisco Tower

officials handle a higher proportion of airline flights; yet, San Jose and Oakland FAA Tower officials handle a larger number of total flights (general aviation and airline).

Freight Handling

The rapidly changing conditions of the air freight business make this segment of airport employment the most difficult to project. Because airline cargo operations depend on frequency and diversity of schedules and because all-cargo airlines have established facilities at San Francisco Airport, it is unlikely that the proportion of air cargo handled at the Bay Area airports will radically change in the future. The concentration of freight forwarders around San Francisco Airport will also reinforce the major cargo role of this facility. Discussions with a number of freight handlers indicate that they have recently moved to their present sites and have relatively long-term leases. Therefore, it is unlikely any of these forwarders would move in the next five to ten years. Some freight handlers, however, are running out of space and looking elsewhere near the airport. They indicated that the further away they locate from the airport, the higher their labor costs will be.

Finally, it is anticipated that improvements in cargo handling may result in a lower ratio of freight handling employees per ton of air cargo. This shift is due to the increased use of containers.

Hotels

Hotels near airports essentially fill a demand for two markets. The first market is that of the visiting air traveller who is looking for hotel accommodations near the airport. The second market is the traveller/businessman attending a seminar or short conference.

Hotels within three miles of the airports cater to both of these markets. However, there are further distinctions that need to be made. San Jose Airport is within three miles of downtown San Jose. Therefore, hotels in downtown San Jose provide service for the air traveller as well as for all people coming by other means to San Jose. On the other hand, the hotels at Oakland Airport are not near downtown Oakland, but they provide the largest grouping of hotels in Oakland and thereby serve both air travellers and other visitors to the City of Oakland. Finally, the hotels around San Francisco Airport serve predominantly air travellers. They also provide accommodations for spillover reservations from downtown San Francisco hotels and for auto travellers looking for hotels convenient to the freeway.

Discussions with representatives of the hotel industry and county convention bureaus indicate that there is no major new hotel growth currently anticipated around either San Francisco or Oakland Airports. On the other hand, a new 500 room hotel will be developed in the downtown section of San Jose.

Businesses Needing Proximity to Airports

Past studies on employment induced by increased airport activity focus on businesses that desire to be located near airports. Included are such businesses as wholesale trade, professional and business services, and manufacturing industries that transport cargo by air.

An analysis was therefore conducted of businesses within a 15 minute driving distance of the airports to see if certain categories of employment are concentrated around the airport. Industries that were specifically studied included those from a 1970-75 survey conducted by the Economic Development Administration, U.S. Department of Commerce, that indicated proximity to scheduled airline service was a significant consideration in choosing a location for their business. The analysis showed no clear relationship between airport growth and increased employment in the categories reviewed. The only discernable employment categories linked to airport activities are off-airport car rental agencies and parking facilities.

D. AIRPORT EMPLOYMENT PROJECTIONS

Employment

- San Francisco will continue to have the largest employment of all three airports, due to its share of the regional passenger market and due to the concentration of interstate and international flights that require more airline staff. (See Table XII-1)
- Airline employment at San Jose and Oakland will grow at a faster rate than San Francisco due to new service development at these airports.
- The number of airline employees necessary to handle Oakland and San Jose flights will not reach the same proportions as San Francisco Airport, again due to the preponderance of shorter distance flights, with smaller airline staffing needs.
- The number of government employees located at all airports will grow at a slow rate. Total government employment at San Francisco will actually decline due to the relocation of the U.S. Coast Guard to Sacramento.
- Employment in air freight handling is expected to increase sharply and to continue to be concentrated at San Francisco Airport, despite some inconveniences due to lack of available land for expansion.
- Growth in nearby hotel employment will not be as large as in the past due to increased competition from downtown San Francisco, San Jose and Oakland.
- There will be increased employment in off-airport parking and car rental agencies, particularly at San Francisco Airport.
- It could be anticipated that a North Bay airport would create an additional 150-250 new airline jobs assuming the 1 to 2 million annual passenger allocation in the regional plan.

Land Use Impacts

- The majority of new airport employment will be readily accommodated on the airport.
- Oakland and San Jose have sufficient land to meet almost any type of future airport expansion needs.

TABLE XII-1

TOTAL AIRPORT EMPLOYMENT

<u>Year</u>	<u>Forecast Range</u>	<u>Alter- native</u>	<u>San Francisco</u>	<u>Oakland</u>	<u>San Jose</u>	<u>North Bay</u>	<u>Total</u>
1977	Existing		25,728	4,806	1,101	*	
1987	Low	1	29,510	5,862	1,608		36,980
		3a	26,545	6,892	1,981		35,418
	High	1	32,061	5,977	1,783		39,821
		2	30,530	6,820	1,771		39,121
		3a	28,114	7,255	2,234		37,603
		3b	28,114	7,255	2,234	800	38,403
		4a	29,510	7,255	1,783	800	39,340
1997	Low	1	31,820	6,458	1,908		40,187
		2	29,541	7,436	1,885		38,862
		3a	27,401	7,832	2,532		37,765
	High	1	35,802	6,798	2,250		44,850
		3a	29,099	8,610	3,057		40,766
		3b	29,099	8,610	3,057	1,000	41,766
		4a	30,085	8,607	2,544	1,000	42,236
		4b	28,983	9,103	2,544	1,000	41,630
		4c	29,283	7,832	2,514	1,500	41,159
		4d	30,099	8,844	2,544		41,487

Alternative 1 - Existing Airport Shares

Alternative 2 - Airline Plan

Alternative 3 - Regional Airport Plan

Alternative 3b - Regional Airport Plan with North Bay

Alternative 4 - San Jose Constrained

- San Francisco, with its limited amount of vacant land, will be faced with difficulty in providing for certain types of airport-related employment needs. Space for current and future freight handling is of particular concern. The San Francisco Airport/San Mateo County Joint Land Use Study will address these needs.
- The growth of off-airport car rental and parking agencies will need to be addressed in the General Plan policies of impacted cities.

Secondary Employment Impacts

- People employed in the seven airport-related job categories require services provided by "local-serving" employment. Local serving employment includes such categories as retail trade, professional and business services and state and local government. The range of projected secondary or local-serving jobs is shown below:

SECONDARY EMPLOYMENT ESTIMATES

(Number of Local-Serving Jobs)

	<u>San Francisco</u>	<u>Oakland</u>	<u>San Jose</u>
Existing	37154	6341	2181
1987 Range	39326- 45370	7933- 10783	3375- 4823
1997 Range	39929- 50672	8690- 14337	3905 6529

XIII. APPENDIX

HISTORICAL DATA FOR KEY VARIABLES

Year	-1- Bay Area Passengers	-2- U.S. Passengers	-3- Bay Area % of U.S. Passengers	-4- Bay Area Population	-5- Bay Area Employment	-6- Bay Area Income	-7- Bay Area Per Capita Income	-8- Bay Area C.P.I.	-9- U.S. G.N.P.	-10- U.S. Fares
1960	5.052	174.512	4.1%	3.639	1.229	\$12.219	\$3.358	87.8	\$736.8	6.874
1961	5.105	176.024	4.1	3.780	1.257	12.875	3,406	88.9	755.3	7.01
1962	5.458	175.634	4.0	3.906	1.310	13.582	3,477	90.3	799.1	7.12
1963	6.960	154.806	4.5	4.034	1.356	14.496	3,593	91.5	830.7	6.73
1964	8.076	177.040	4.6	4.160	1.403	15.342	3,688	92.9	874.4	6.59
1965	9.783	205.840	4.8	4.262	1.455	16.150	3,789	94.7	925.9	6.41
1966	11.772	236.122	5.0	4.368	1.540	17.123	3,920	97.1	981.0	6.00
1967	14.424	284.998	5.1	4.459	1.606	18.032	4,044	100.0	1007.7	5.64
1968	16.434	324.362	5.1	4.536	1.679	18.975	4,183	104.5	1051.8	5.38
1969	17.688	363.796	5.1	4.599	1.748	19.580	4,257	110.2	1078.8	5.27
1970	17.518	338.844	5.2	4.637	1.752	19.821	4,275	115.8	1075.5	5.16
1971	17.210	347.338	5.0	4.692	1.737	20.244	4,315	120.1	1107.3	5.21
1972	18.643	382.698	4.9	4.737	1.788	21.217	4,479	124.3	1171.1	5.11
1973	19.831	404.416	4.9	4.778	1.880	21.828	4,568	131.5	1235.0	4.98
1974	20.643	414.916	5.0	4.802	1.934	21.509	4,479	144.4	1217.8	5.09
1975	20.888	410.124	5.1	4.829	1.937	22.296	4,617	159.1	1202.3	4.76
1976	22.390	446.636	5.0	4.873	1.992	23.351	4,792	168.0	1271.0	4.79
1977	24.464	480.652	5.1	4.927	2.061	24.465(E)	4,965	180.8	1332.7	4.62
1978	27.708	N/A	N/A	4.977	2.226	24.796(E)	4,982	200.4	1385.1	4.07(E)

UNITS AND SOURCES OF DATA

1. Bay Area Passengers (Millions of On and Off Passengers) - Includes Helicopter, 3rd Level, Supplemental and Non-Scheduled Passenger
2. U.S. Passengers (Millions of On & Off Passengers)- Trunk, Local Service, Alaskan, Hawaiian, Helicopter, Int'l and Territorial Airlines - Air Transport Association Facts and Figures
3. Bay Area Percent of U.S. Passengers - (Column 1 ÷ Column 2) x 100
4. Bay Area Population (Millions) U.S. Bureau of Census and California Department of Finance Estimates
5. Bay Area Employment (Millions) Estimated Number of Wage and Salary Workers in Non-Agricultural Establishments, By Industry - State of California Human Relations Agency
6. Bay Area Income - (Billions of 1967 Dollars) Security Pacific National Bank Data Bank Series
7. Bay Area Per Capita Income (1967 Dollars) Column 6 ÷ Column 4
8. Bay Area Consumer Price Index - Security Pacific National Bank Data Bank Series
9. U.S. Gross National Product (Billions of 1972 Dollars) - Economic Report of the President
10. U.S. Fares - (Revenue per Revenue Passenger Mile (¢)) Air Transport Association Facts and Figures, Adjusted Using U.S. Consumer Price Index

N/A = Not Available

(E) = Estimated

Table A-2

BAY AREA AIR PASSENGER TRAFFIC

YEAR	SAN FRANCISCO	% OF BAY AREA	SAN JOSE	% OF BAY AREA	OAKLAND	% OF BAY AREA	BAY AREA TOTAL	PERCENT INCREASE OR (DECREASE)	RATIO TO U.S. TRAFFIC GROWTH	PERCENT OF U.S. ENPLANEMENTS
1960	4,637,035	91.8%	80,731	1.6%	334,440	6.6%	5,052,206	11.9%		4.1%
1961	4,754,327	93.1	76,437	1.5	274,530	5.4	5,105,294	1.1	.87	4.1
1962	5,036,092	92.3	109,261	2.0	312,884	5.7	5,458,237	6.9	.91	4.0
1963	6,414,620	92.2	119,260	1.7	425,650.	6.1	6,959,530	27.5	1.95	4.5
1964	7,459,461	92.4	124,360	1.5	491,730	6.1	8,075,551	16.0	1.11	4.6
1965	8,706,984	89.0	109,483	1.1	966,636	9.9	9,783,103	21.1	1.30	4.8
1966	10,145,309	86.2	416,850	3.5	1,209,729	10.3	11,771,888	20.3	1.30	5.0
1967	12,248,051	84.9	714,257	5.0	1,461,543	10.1	14,423,851	22.5	1.09	5.1
1968	13,544,414	82.4	1,071,434	6.5	1,818,220	11.1	16,434,068	13.9	1.01	5.1
1969	13,968,980	79.0	1,572,320	6.5	2,146,800	12.1	17,688,100	7.6	1.27	5.1
1970	13,867,941	79.2	1,595,154	9.1	2,055,180	11.7	17,518,275	(1.0)	.67	5.2
1971	13,451,716	78.2	1,704,748	9.9	2,053,769	11.9	17,210,233	(1.8)	-.71	5.0
1972	14,676,025	78.7	1,886,401	10.1	2,080,793	11.2	18,643,219	8.3	.82	4.9
1973	15,567,030	78.5	2,037,787	10.3	2,226,494	11.2	19,831,311	6.4	1.12	4.9
1974	16,201,138	78.5	2,146,157	10.4	2,295,871	11.1	20,643,166	4.1	1.57	5.0
1975	16,362,160	78.3	2,311,238	11.1	2,214,811	10.6	20,888,209	1.2	-1.03	5.1
1976	17,564,033	78.4	2,662,140	11.9	2,164,243	9.7	22,390,416	7.2	.81	5.0
1977	18,912,622*	77.3	3,052,167	12.5	2,499,855	10.2	24,464,644	9.3	1.22	5.1
1978	21,519,923*	77.7	3,400,175	12.3	2,788,176	10.0	27,708,274	13.3	N/A	N/A

Recent Notes:

1976 - SFO Helicopter Sold

1975 - United Strike

1974 - Energy Crisis, National Airlines Strike

1973 - PSA, TWA strikes

1972 - Northwest Airlines Strike, Stol Air Service Instituted, Golden Pacific
ceases operations.

San Jose Service Inauguration Dates: PSA (May, 1966), Air California (October, 1967),
United (August, 1966), Western (June, 1970),
Continental (August, 1970), American (August, 1976),
Delta (June, 1976)

*Estimated on and off passengers. Reporting format changed in 1977.

Source: Airport Records

Table A-3

HISTORICAL CARGO GROWTH IN BAY AREA

FREIGHT (Annual Tons)								
Year	San Francisco	% of Bay Area	Oakland	% of Bay Area	San Jose	% of Bay Area	Bay Area Total	Annual Inc. or (Dec.)
1965	173,865.5	98.3%	2,596.5	1.5%	475.5	.2%	176,937.5	38.8%
1966	216,573.5	98.3	3,181.0	1.5	479.5	.2	220,234.0	24.5
1967	249,127.0	98.0	4,391.5	1.7	604.5	.3	254,123.0	15.4
1968	285,914.0	98.3	4,032.0	1.4	935.0	.3	290,881.0	14.5
1969	312,905.5	97.7	5,313.5	1.7	2,086.5	.6	320,305.5	10.1
1970	316,205.0	96.5	8,832.5	2.7	2,744.5	.8	327,782.0	2.3
1971	305,493.0	96.9	5,644.5	1.8	3,998.0	1.3	315,135.5	(3.9)
1972	323,378.0	97.2	5,296.5	1.6	4,115.0	1.2	332,784.5	5.6
1973	373,458.5	97.6	4,586.5	1.2	4,670.5	1.2	382,715.5	15.0
1974	362,391.5	96.2	5,209.5	1.4	6,810.5	1.8	374,411.5	(2.2)
1975	324,980.5	95.9	6,861.0	2.0	7,144.0	2.1	338,982.5	(9.5)
1976	342,003.5	95.4	7,140.0	2.0	9,450.0	2.6	358,593.5	5.8
1977	371,658.1	95.3	7,071.0	1.8	11,398.0	2.9	390,127.1	8.8
1978	413,002.1	94.0	13,769.5	3.1	12,796.7	2.9	439,568.1	12.7

AIR MAIL (Annual Tons)								
Year	San Francisco	% of Bay Area	Oakland	% of Bay Area	San Jose	% of Bay Area	Bay Area Total	Annual Inc. or (Dec.)
1965	54,633.5	97.8%	929.5	1.7%	278.0	.5%	55,841.0	37.4%
1966	87,886.0	98.5	1,089.5	1.2	294.0	.3	89,269.5	59.9
1967	108,895.5	98.8	1,215.5	1.1	106.0	.1	110,217.0	23.5
1968	138,777.0	98.9	1,165.0	.9	340.0	.2	140,282.0	27.3
1969	135,379.5	98.6	1,435.5	1.0	568.0	.4	137,383.0	(2.1)
1970	150,398.5	99.2	1,097.0	.7	68.0	.1	151,563.5	10.3
1971	131,866.5	99.2	1,086.0	.8	48.0	--	133,000.5	(12.2)
1972	111,799.0	99.1	991.0	.9	77.5	--	112,867.5	(15.1)
1973	93,729.0	99.3	531.0	.6	120.0	.1	94,380.0	(16.3)
1974	90,801.5	99.3	503.0	.6	115.5	.1	91,420.0	(3.1)
1975	92,904.5	99.1	633.0	.7	235.5	.2	93,773.0	2.6
1976	95,300.0	98.2	1,070.0	1.1	665.0	.7	97,035.0	3.5
1977	98,473.9	98.4	827.1	.8	832.1	.8	100,133.1	3.2
1978	104,349.0	98.3	1,044.8	1.0	761.7	.7	106,155.5	6.0

Source: Airport Records

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